

AVIATION WEEK

A MCGRAW-HILL PUBLICATION



AUGUST 16, 1954

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Maintaining The H-Bomb Fleet



AIR MATERIEL COMMAND EDITION

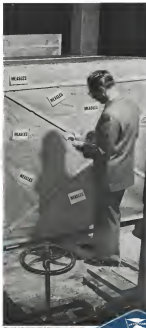
"futures unlimited" with ZENITH AIRCRAFT

The sky is literally the limit with the new, vastly expanded facilities for reinforced plastic production of Zenith Aircraft—Division of Zenith Plastics Co. New ideas—new developments—transcendently broadened horizons in Radar and Electronic applications, Guided Missiles and primary structures in aircraft—will result from Zenith's continuous program of research. Write for brochure "Futures Unlimited" for a picture of progress and a glimpse of a future without limitations, to Zenith Aircraft, Division of Zenith Plastics Co., Gardena, Calif.

World's largest floor
devoted to the production of Reinforced Plastics for Aircraft



ZENITH AIRCRAFT *gardena, calif.*
Division of Zenith Plastics Co.



WE'RE SHIPPING MEASLES BY THE CARLOAD —for the B-52!

"Measles"—that's the code word used to identify shipments of many fuel tanks built by Goodyear for the Boeing B-52 jet bomber.

These particular tanks call for a multiple construction utilizing a rip-ras-proof bladder, with self-sealing portage protruding areas exposed to direct gunfire.

The quality control governing the production of Goodyear Aviation Fuel Cells is, we believe, the most thoroughgoing in its field.

For example, the B-52 tank is subjected to exhaustive testing in accordance with applicable Military Specifications. In addition, each tank is phenol tested to ensure a fuel tight container, pig-checked to assure proper fit in the airplane—plus a detailed rack-by-rack inspection of each tank after curing.

The fittings—and there are more than 80 of them in a set of these Boeing tanks—are critically examined through profilometers, thermal M.D.G., micrometers, various calipers, torque gauges before they are finally stamped for shipment under the "measles" label.

This tremendous investment in man power and testing equipment is a major factor in the universal acceptance of Goodyear Fuel Cells—whether they be small Phoenix giant bladder cells, rip-ras proof or heat-resistant units.

That's why so many commercial, military and private aircraft rely on Goodyear Fuel Cells. Experience proves you can depend on their performance!

Goodyear Aviation Products Division
Akron 16, Ohio or Los Angeles 54, California



FACILITIES + ABILITIES = EXTRA IN PERFORMANCE



Midgets or Giants?

You'll find both in PROTO's EXPANDED Line of Turboprops.

Recent additions of PROTO Turboprops make it possible for you to now have the expanding tool in drive sizes from 5" "midgets" to 50" "giants" and with capacities ranging from 500 to 5000 inch-pounds. Major aircraft companies have found this torque-hauling versatility to be faster and sturdier than other types used. These features, plus automatic reduction, microcomputer-type adjustment, trouble-free construction, and elimination of pointers and shafts, have resulted in extensive approval of the Turboprop by the aircraft industry. Ask for an on-the-job demonstration, and here the results you need—data or relief. Send us your PROTO dealer, head line for 60-page catalog of entire line.

PROTO TOOL COMPANY
2221A Santa Fe Ave.,
Los Angeles 34, Calif.

FLASH!
PROTO Turboprops are supplied to the U.S. Air Force under Military Specification MIL-H-4234A (USAF).

PROTO TOOLS
POWER AND TORQUE

Circle 11 on Reader Service Card

AVIATION WEEK

August 16, 1954

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Air Force Adopts SKYDROL For C-118A Superchargers



After test studies lasting more than a year, fire-resistant Skydrol hydraulic fluid is now specified for the superchargers of all new Douglas C-118's of the Military Air Transport Service. With this improvement, chemical-base Monsanto fluid will replace present petroleum oils.



SKYDROL OUTLASTS MINERAL OIL 10 TO 1

Seven supercharger superchargers. Skydrol has long been approved for 4,800 hours in Douglas C-118 supercharger assemblies, compared with 200 hours for mineral oil fluids. Thus, fewer fluid changes and reduced servicing save the Air Force money.

Skydrol's lubricity is demonstrated by the longer service life of com-

ponent parts in Skydrol lubricated systems.

Skydrol is noncorrosive to aircraft metals and alloys.

Skydrol is readily adaptable to all types of aircraft with minor changes to the hydraulic system.

Skydrol is stable at required operating temperatures and pressures.



Write for 36-page brochure containing technical data on Skydrol Organic Chemicals Division, Monsanto Chemical Company, Box 400, St. Louis 1, Missouri.

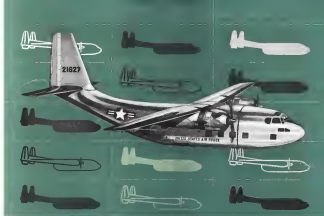


Circle 12 on Reader Service Card



The ability to combine practical experience with technical knowledge to solve advanced aircraft bearing design problems has been a specialty of Fafnir Bearing Engineers for more than a quarter century. A typical product of this combination is the Fafnir Super-Preload Ball Bearing — specially designed and custom made for use on main rotor shafts in high speed jet engines, engine refrigeration equipment, starters, pumps, etc. The Fafnir Bearing Company, New Britain, Connecticut.

FIRST . . . at the turning point
in aircraft design.



Close to full-scale production at Fairchild — the new C-223 Assault Transport will fill specialized military requirements for an air transport sufficiently versatile to deliver men or equipment at advanced bases. This sturdy craft readily converts from a carrier of 69 fully equipped combat troops to a cargo plane delivering more than 15 tons of equipment.



Source: *Chicago Tribune*, *Metropolitan Daily*, 1911
 Edgar Davis, *Chicago*, 1911 • *Grand Dakota Street*, *Westwood*, 1911
South Dakota Street, *Metropolitan*, 1911 • *South Dakota Street*, *Metropolitan*, 1911

75%
of all the helicopters
flying today have

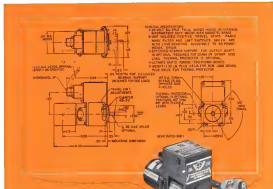


Franklin engines power 4 out of the 5 CAA certificated helicopters under 400 h.p. — Bell, Hiller, Sikorsky and McCulloch. The production of these four manufacturers in the under 400 h.p. category has accounted for 75% or more of all the helicopters in the world, all powered by Franklin engines made by Aircooled Motors, Inc.

Aircooled Motors is also a major subcontractor of precision machining

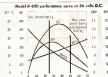
The same men and plant responsible for the extraordinary success of Franklin helicopter engines can accept additional subcontract work similar to that long produced for major companies in the aircraft field. We are fully equipped for quantity production of precision machining and sub-assemblies of the highest quality. Your inquiries are invited.

AIRCOOLED MOTORS, INC., SYRACUSE, N. Y.



THE ACTUATOR THAT KNOWS WHEN TO STOP

Once the original limits are set, this compact rotary actuator actually "senses" the additional load imposed by running against the adjustable stops, and holds automatically. This load-sensing feature, plus the positive stops, eliminates over-torque completely. These features have attracted the attention of such leaders as Grumman, McDonnell, Lockheed, North American, Republic, Fairchild, A. V. Roe, and Piasecki—all of them now large-scale ROTOFlex users.



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ACCESSORIES CORPORATION
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ROFOLON

COMPLETE INFORMATION
on the Rotoflex line of precision-machined
actuators is published in the new Rotoflex
catalog. Send for your copy today.



A new F-100 Super Sabre in level flight, banking through the sound barrier with a remote and rapid profile, a graceful shock wave—the Sonic Boom.

SONIC BOOM!

THUNDERING SIGNAL OF AVIATION'S PROGRESS FOR NATIONAL DEFENSE

Called "invisitable thunder" when first heard, Sonic Booms have demonstrated to Mr. Average Citizen the fact that we have entered the era of everyday supersonic flight. The mere idea that an airplane flying through the air can produce a sound "like thunder on a clear day" may seem fantastic. Actually a Sonic Boom is a perfectly natural occurrence—a sort of "popcorn" pop—brought about by a jet plane flying faster than sound. Very much like waves made by a motorboat on a lake—a jet creates gigantic shock waves in the air—so intense that when they reach us on the ground, they sound like thunder or a rattling explosion.

Once a surprising new sound—the noise of Sonic

Booms is now understood, and positive steps are taken to reduce the probability of Booms over our homes. For instance, North American began early testing of supersonic speeds over remote areas. These experiments have led to rigid control of all flights. Today, the aircraft industry and the Armed Forces prevent disturbing Booms by making supersonic flights at extreme altitude or away from our cities and towns.

While you read these words, planes designed and built by North American—the F-100 Super Sabre and the new F-100 Super Sabre—America's first operational fighter to fly at supersonic speeds in level or climbing flight—fly vital defense missions without disturbing your daily life.

Engineers at North American offer annual opportunities to qualified engineers seeking a challenging future. Please write: Engineering Personnel Office, Los Angeles or Downey, California or Columbus, Ohio organization, facilities and experience help.

North American Aviation, Inc.

years ahead in aircraft... atomic energy... electronics... guided missiles... research and development.



From the drawing boards that engineered the famous V-200-12 A



The new VALCOR V-3900 is unique. The exceptional operating advantages of the VALCOR design and design has been improved even further...

New ruggedness of 1/2 the weight
New compactness of 1/2 the weight
New dependability of 1/2 the weight

Yet the same flow capacity as the V-200-12A.

This remarkable achievement means a greater freedom of design for the engineer than ever before. The VALCOR V-3900 is setting new standards of Solenoid Valve performance where low pressure drop and lightweight are a factor.

Design Features of the Valcor V-3900 Shock-Off Valve

- Weight—1/2 lbs.
- Absolute minimum pressure drop through valve.
- Patent Pending Seal (Seal Type)
- Simplicity of design
- 90% efficient seal in both directions
- Full impulse-resistant checking
- 1/4" NPT 90° SOLINOID COILS COME WITH 1/4" NPT 90° CHECK, 1/4" NPT 90° VALVE AND 1/4" NPT 90° VALVE

SPECIFICATIONS

Operating voltage—10 to 120 V.A.C.
Control Voltage—10 to 120 V.A.C.
Area Operating Pressure—100 PSI
Flow—400 GPM
Other port sizes available either normally open or normally closed. Designed to conform to latest military specifications. For full

USES

Auxiliary power with fuel systems
Brake Systems
Water Injection Systems
Cabin Pressurization
Pneumatics
In flight refueling

VALCOR

SOLENOID VALVES

WRITE FOR
DETAILED INFORMATION

VALCOR[ENGINEERING, CORP., CARNEGIE AVE., KENILWORTH, N. J.

A **Breeze** from
for a Tornado

JOY AXIVANE[®] AIRCRAFT FANS



The North American B-45 "Tornado" Bomber, like most U. S. aircraft, has many features designed solely for the flight personnel's comfort.

Acting on the logical assumption that a more comfortable pilot is a better pilot, North American engineers called for a cockpit-cooling system of Joy Axivane Fans to keep the flight personnel from melting while waiting for take off on hot days. When the "Tornado" is airborne, the fans are used in conjunction with a heating system to furnish warm air for cockpit defrosting. On the B-45 pressurized bomber, the same fans also keep the camera ports free from frost or fog.

The versatility of this system is largely dependent upon that of the Joy AXIVANE Fan. The fans used on the B-45A, B-45C, and B-45G provide 250 CFM at 6.5" W.G., yet they are only 6' 9" in diameter and weigh but 9 lbs.

• Joy designs and builds each fan to the exact requirements for which it is intended. Each fan, therefore, is custom-engineered for highest efficiency. For many purposes such fans can be supplied from the extensive fan already designed. Both single and remountable units available. Optional features include gangster or flange inlet, hand or foot operated connections, oil-free operation, stainless steel, and cooled motors where required.

* * * * *

Here are some of the many uses for JOY AXIVANE Aircraft fans: Windshield de-icing, windshield or wing de-icing, cabin heating, exhaust ventilation, cockpit heating, cooling radio and electronic equipment, cooling voltage regulator, air recirculation, and high-altitude pressure breathing. • Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa., In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

JOY

SPECIALISTS IN THE COMPRESSION AND
MOVEMENT OF AIR AND GASES SINCE 1881

Consult a Joy
Engineer

For Tornado Fans ... Compressors, Blowers
Pumps and Belts ... Vapour Generators



JOY & CO.

HANNAY HOSE REELS ... UP FRONT



Photo Copyright by Associated Press Photo

Check the Superior Advantages HANNAY Electric Drive HOSE REELS

- WATER RESISTANT
- VAPOR RESISTANT
- EXPLOSION - PROOF

- ★ Extra strong, withstand high pressures
- ★ Explosion proof, heavy duty motor, sealed against fog, steam, fumes, water
- ★ Sealed push button control, no gears to shift, no clutch to engage
- ★ Safe control speed, always under control

... LOOK FOR THIS



Yes ... in performance and service, Hannay Hose Reels are "top line". The dramatic illustration above shows Air Force Fire Fighters spraying foam from a new American LaFrance snark truck on burning aircraft. And the reel, of course, is a Hannay, specially designed for military service. When YOU need good hose reel, standard or special performance, remember HANNAY ... built to do a BETTER job, in fire-fighting, in industry, in national defense.



CLIFFORD B. HANNAY & SON, Inc.

MANUFACTURERS OF MANUAL AND POWER OPERATED HOSE REELS FOR EVERY PURPOSE

USS Carilloy steel passes rigid tests for propeller blades

A n important manufacturer of propellers for military aircraft has found that in stringent tugboat tests, USS Carilloy steel performs completely satisfactorily.

The high stresses in propeller blades and hubs naturally require extremely high quality steel. Accordingly, the U.S. Army and U.S. Navy have set up rigid quality specifications requiring that every heavily stressed part must be manufactured several times during its production.

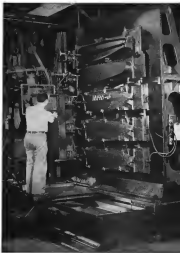
With USS Carilloy 4340 electric furnace aircraft-quality steel, this important manufacturer is able to count on the performance required for this severe application. The consistent high quality of USS Carilloy aircraft steel has meant greater savings to this customer through minimum maintenance rejection of costly fabricated parts.

USS Carilloy steels have established an enviable record for meeting the highest quality requirements. Therefore, when you need a standard AISI analysis or a special steel for an unusual application, it pays to call in a USS Service Metallurgist. He can help you solve any steel problem.

AFTER FORGING AND MILLING 7½ ft. thrust section are brought out on the lathe. The other finished sections weigh about 150 lbs. USS Carilloy steel exceeds a No. 1 quality position in these heavy duty parts.

THESE HIGH QUALITY aircraft propeller hubs are forged and machined from semi-finished Carilloy 4340. They meet extremely tough tugboat requirements.

FOR THE PROPAGATOR, 2 forged sections (a) are welded together to form one blade thrust member. Flares are then ground and polished. Reflected, ground and super-polished ends (b) are ground down so they are square based to fit thrust members. Hubs (c) are heat treated and polished before final centrifugal test and customer plating. Diagrams throughout testing ensure that every finished blade (d) can withstand the tremendous stresses encountered on the latest high speed planes.



UNITED STATES STEEL CORPORATION, PITTSBURGH - CHICAGO OFFICE STEEL DIVISION, CHICAGO
 THUNDER BOLT & SON DIVISION, PITTSBURGH - UNITED STATES STEEL SUPPLY SYSTEM, WASHINGTON DISTRICT
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Carilloy USS Steels
 UNITED STATES OF AMERICA
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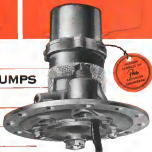
UNITED STATES STEEL

ON HELICOPTERS...

OR EXECUTIVE AIRCRAFT...



HERE ARE DEPENDABLE PUMPS ADAPTABLE TO MANY REQUIREMENTS



Peeco Model 127731 100 Submerged Fuel Booster Pump. Rated output of base model 100 pounds per hour at 10.5 psi at 1750 rpm. 2 1/2 inch shafted model is rated for requirements up to 1000 pounds per hour at 10 psi at 1750 rpm. Weight approximately 3 pounds.

Peeco fuel booster pumps have proved their exceptionally high performance and dependability in thousands of installations on military, commercial, and civilian aircraft of all types. Peeco's complete line of small sized booster pumps for executive airplanes, helicopters, tankers, target drones, etc., provides advanced equipment to meet your future requirements.

Call or write the Mono Office, Bedford, Ohio for full information on these Peeco products as applied to your specific installation.
HYDRAULIC PUMPS • BOOSTER PUMPS • FUEL PUMPS
AIR PUMPS • ELECTRIC MOTORS • POWER PACKS

Performance requirements for aircraft are the most exacting we have today — and Peeco has contributed greatly to dependable aircraft performance through advanced engineering and precision production of fuel and hydraulic pumps. Typical of these is the Peeco line of small Fuel Booster Pumps which encompass several important advantages for all aircraft applications.

First is their great flexibility. An example of this flexibility, the model illustrated was designed basically to pump 300 pounds per hour at 10.5 psi. Slight modifications provide pumping at rates as high as 1,000 pounds per hour—with the same constant pressure!

Second, all Peeco submerged fuel booster pumps are driven by motors designed and built by Peeco. This single responsibility of design and manufacture insures full coordination for optimum performance.



BORG-WARNER CORPORATION
24705 NORTH HILLS ROAD • DELAWARE, OHIO



The great transmission of the Hiller HTE-3, made by WESTERN GEAR WORKS, uses Timken bearings in the shaft of the gear train to assure dependability and long life.



Entire weight of Hiller helicopter hangs by TIMKEN® bearings

THREE lives, plus the Navy HTE-3 Hiller helicopter itself, depend on Timken tapered roller bearings. In the air, the helicopter hangs onto its rotor blade shafts with Timken bearings in the main and tail rotor gear box. The drive gear featured alone, made by Western Gear Works, uses Timken tapered roller bearings to assure dependability and long life.

The tapered construction of Timken

bearings enables them to take radial and thrust loads in any combination. As a result, Timken bearings on the rotor shaft absorb the heavy thrust-weight load of the rotor and pilot. At the same time, they easily handle the radial load imposed by the rotor shaft as it whirls at 335 rpm.

Because of their tapered construction, Timken bearings hold the rotor shaft in positive alignment. This assures accurate meshing of the drive

gears, minimizes wear on gears themselves. And full line contact between rollers and races gives Timken bearings extra load carrying capacity.

To get dependability like this in the equipment you build or buy, specify Timken bearings. The Timken Roller Bearing Company, Canton, Ohio. Cable address "TIMKNSCO".



This symbol on a product means its bearings are the best.



WE MAKE OUR OWN STEEL

The special steel alloy used to make these Timken bearings has a clean strength and resistance to wear is made in our own steel mills.

The Timken Roller Bearing Company is the only manufacturer in the world that designs, produces and finishes, 3-point quality control, 4-point customer service.

TIMKEN
TAPERED ROLLER BEARINGS



NOT JUST A BALL • NOT JUST A ROLLER • THE TIMKEN TAPERED ROYALTY • BEARING TYPES: RADIAL • SHOCK RESISTANT • LOADS GO ANY COMBINATION

We've Whipped TD*

TD Proofed Servo Motors



... Another Flight-Improving First



by

Greenleaf

WHERE QUALITY CONTROL
WORKS ON THE PRODUCTION LINE

• **TD MEANS TORQUE DECAY** TD in a single servo loop can keep an airplane grounded for hours, even days TD is like cancer in the human body. It is the gradual mercurial working away of torque due to internal changes of components in a servo motor. It shortens life, destroys accuracy, and efficiency.

New Life for Servo Motors

Now Greenleaf offers you servo motors that are TD-proofed. Actually, Greenleaf methods and ingenuity have reduced TD by as much as 1500%. This is true for all Greenleaf electro-servo rotating devices. This is another example that shows why Greenleaf is regularly selected as a prime or sub-contractor by the following: U.S. Air Force, U.S. Navy, McDonnell Aircraft, Boeing, Emerson Electric Company, Eastman Kodak, Aero-Whig Corporation and other leading organizations.

See Greenleaf for Servo Motors and for Gyros, Pressure Transmitters, Accelerometers, Synchros, Air Speed Indicators, Actuators and other precision built and components.

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See us at AIAA at the
National Aircraft Show
August 1966,
Sept. 1-3 & 11-13

Engineering
Development
Production



Carrier Based Jets to have Radar Guided Missiles

NAVY'S AIR-TO-AIR SPARROW 1 IN PRODUCTION

THE STORY BEHIND THE STORY

• On May 12, newspapers from coast to coast carried headlines like the ones above, announcing the Navy's newest weapon of defense—Sparrow 1—and the beginning of volume production for operational use in the fleet.

• Ahead of time! Behind were 7 years of intensive cooperative effort shared by the Navy's Bureau of Aeronautics and Sperry-

• Originally designated project 2807 SHOT, Sparrow began back in 1947 when the Bureau of Aeronautics assigned to Sperry the full responsibility of creating an entirely new air-to-air missile system. It had to be light and compact—so multiple units could be carried by fighter-type jets. It had to be deadly accurate—capable of outmaneuvering the swiftest bombers an enemy could produce. And it had to be practical—suitable for large-scale production.

• The rocket-powered, radar-guided Sparrow 1, coming off the production line here and at the new Sperry Fairview plant in Bristol, Tennessee, meets these requirements—and more. It embodies the proved features of more than 100 different missiles designed, constructed and tested during a 7-year period—and the finest brains of an organization that has devoted more than 40 years creating and manufacturing electronic flight control and fire control systems.

SPERRY RADARSCOPE COMPANY

SPERRY CORPORATION • 100 EAST 42ND ST. • N.Y.

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Breakdown terminals for fast removal, stripping and reconnection, stripping or pulling conductors after its bonding.



For overall engine starting, recommended storage terminal, and allowing easy adjustment.



Subminiature, heavy number of contacts as it is standard connector and it fits in the space.



Universal for auto, control, instrument, etc.



Standard service and plug type.



Automatically secured 1/4 inch & 1/2 inch terminals for fast removal and installation.

Special 1/4 inch connector for TV camera.

Water tight and weather proof connector for rugged service.



Heavy-duty 1/4 inch plug, with connector for C. E. Army Ordnance, integration in electronic unit. Reduced vibration. Special connector.



Greater security of contact and high temperature protection.

More power plugs and connectors for a wide range of applications.



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TEST ANY MAGNETO

R-985 to R-4360...hi- or lo-tension



TE 5037 HI-LO TENSION MAGNETO TEST STAND

Here's savings spelled out in dollars! Here's one test stand that will replace a whole shop full of miscellaneous magneto test units. In pairs or singly, you can test any magneto regardless of size...test any magneto whether high tension or low tension!

Finger-tip controls...handy work table area...arousing freedom from vibration...PAC's famous built-to-take-it easy maintenance construction! Modernize with a TE 5037 Hi-Lo Tension Magneto Test Stand now! You'll speed up every magneto job, you'll save money and valuable shop space, too!

Test and Handling Equipment Division
Dimensions: 8' 10" high; 36" wide, 64" long.
Shipping weight approximately 1200 pounds.

Write for PAC's new Equipment brochure. It describes test and ground handling equipment that has the whole industry talking!

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Airmotive
Corporation**

Other Divisions: China and Oakland, California
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2940 N. Hollywood Way, Burbank, Calif.
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50th ANNIVERSARY - POWERED CARRIAGES

50th ANNIVERSARY - POWERED FLIGHT

Some of the great names in the Motor Car Industry recently celebrated their 50th Anniversary and now the Aircraft Industry relates its dramatic and enchanting history of Powered Flight over a fifty-year period. • The astounding growth of these two industries would have been impossible without forgings which are used wherever maximum strength with minimum weight is essential. • Wyman-Gordon has been privileged to serve these industries from their beginning... has kept abreast of progress and has pioneered many advancements in Forging and Heat Treating techniques and in quality control. • There is no substitute for a Forging - and in a Forging there is no substitute for Wyman-Gordon quality and experience.

WYMAN-GORDON

Established 1885

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM
Worcester, Massachusetts

HARVEY, ILLINOIS

DETROIT, MICHIGAN



To keep pace with the growing need for completely reliable aircraft instrumentation and control components, the Aircraft Products Division of Manning, Maxwell & Moore, Inc. is now manufacturing in three strategic locations: Stratford and Danbury, Connecticut and Inglewood, California.

The expansion and dispersal of our facilities greatly augments the availability of our design, engineering, testing and production facilities. Whether your responsibilities concern the application of aircraft pressure switches, electronic amplifiers, hydraulic valves or turbine engine control systems, we can now serve you better than ever

before. Whatever the dimensional and functional requirements of such vital components, our unique design techniques always take all compromise with performance. For we recognize that compatibility between aircraft and equipment is the key to the success of the weapons system of the U. S. Air Force, as well as the continued leadership of the nation's air transportation industry.

We believe the counsel of our engineering specialists can contribute appreciably to the safety and dependability of today's most advanced aircraft and those you are now developing. Your inquiry is invited.

MANNING, MAXWELL & MOORE, INC.

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For "Happy Holidays"

it's EASTERN...



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[These weather stories prepared in consultation with the United States Weather Bureau]



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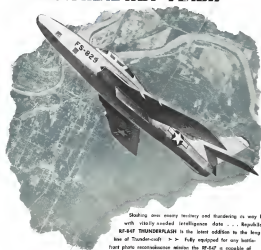
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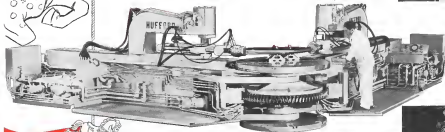
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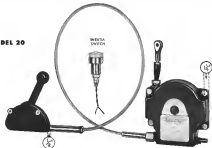
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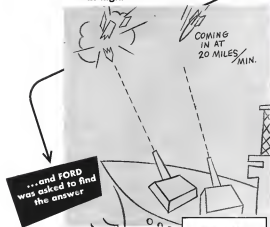
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AVIATION WEEK

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Volume 61 No. 7
August 16, 1964

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■ AMC DOCUMENTARY REPORT

This special Air Materiel Command issue of *Aviation Week* was prepared, for both the Air Force and the aircraft industry that serves it, as a documentary report on the profound and far-reaching changes now in process for weapons systems procurement, global logistics and maintenance and logistical activities.

Aviation Week editors and staff writers traveled 45,000 miles, most of it by air, in conducting the research and personally interviewed leaders of the Materiel Command's efforts, civilian and aircraft industry executives. In this effort they covered one phase and effective cooperation from Gen. Edwin F. Remsburg, AMC Commander, and his staff.

Robert R. Ritz, executive editor, was official director of the special project, assisted by Frank Shaw, Jr., associate editor.

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AMC-Industry Gear For Swift Combat Support

PRESENT NATIONAL POLICY has defined air power, armed with nuclear power, as a primary force in the defense of our nation and the free world. This must be air power in being, ready to strike back immediately and decisively.

AIR MATTER COULD be the logical arm of the Air Force, exists for the sole purpose of keeping the operating units of the Air Force supplied with the quality and quantity of weapons and equipment essential to victory—cost with efficiency and economy. To meet the responsibilities of present national policy we are having to gear all of our activities to the fighting needs of modern air warfare.

THE MAGNITUDE OF THIS TASK, which is recognized by us, has intensified our efforts. Our program to keep legislation in step with technological improvement and evolving military strategy is always a primary goal. Our present threefold program is only one of many ensuring this accomplishment.

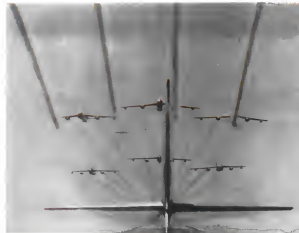
Our first objective is to get and to keep all of our available resources in constant readiness. Secondly, we are aiming at adequate, simple but better logistical procedures throughout our operations. Thirdly, we are working to release both the time element and the cost of essential equipment in our logistical pipeline.

I am confident that with the continuing support of industry, which is the source of American air power, we can achieve this. We CAN give our fighting Air Force units the support with which the strength and striking power for freedom CAN be maintained.

Edwin W. Bealings

E. W. Bealings, General, USAF
Commander, AMC

AVIATION WEEK, August 16, 1954



INSTANT COMBAT readiness of Strategic Air Command's B-47 heavy bomber wing requires effective support from AMC.

AMC Streamlines Management Pattern

By Robert Hottel

Dayton—The Air Materiel Command is in the midst of a managerial revolution that is changing its basic pattern of doing business within the Air Force and externally with the aircraft industry from which it buys weapons systems and supporting equipment.

AMC's managerial revolution is aimed at helping to solve two relatively new problems faced by USAF.

They are:
• Necessity for handling and maintaining an adequate combat force to bring, and to fight at once, the entire ANMC front support what is essentially a nuclear Air Force within the framework of a peacetime economy.

• Radically changed character of aerial warfare stimulated by swift advances in atmospheric and nuclear weapons de-

velopment that makes it possible to deliver immediate devastation across intercontinental range at enormous speeds. This requires ANMC's production and logistic support for USAF combat forces to match the speed and intensity of modern air war.

"Actually speaking, World War II was a shotgun blast at the enemy," says Gen. Edwin W. Bealings, AMC commander. "We prepared every part of him as could come with an enormous and reckless quantity of planes and

bombs. It was a stochastic war and it was the last of its kind.

• Quality Bombs—Any future major conflict will feature long-range sharp-shooting on a gigaton scale. The push-off as modern air power is not as much for quantity as it is for quality and quick concentrations of force. This can be achieved only through the soundest management of war resources limited resources for defense.

It is AMC's job to develop and provide that "soundest management" for the Air Force share of the "soundest" limited resources for defense.

It is ANMC's job, teamed with the Air Research and Development Command, to provide the best balance of quality and quantity in USAF's annual of available ready-made weapons systems.



SPRAWLING ACRES of Wright-Patterson AFB house AMC HQ, where multi-billion dollar business is managed to procure, supply and maintain.

► **Support Mission**—And it is also AMC's job to provide the proper logistic support to maintain USAF's globalized combat forces at a state of constant readiness to fight, plus the ability to combine that support at moments' notice through the initial and most intense phase of any future conflict. The work of AMC is a major step in the long and difficult process of convert-

ing national resources into military capability. Its procurement, supply and maintenance operations lie at the middle of USAF's spectrum, linking research and development at one end with combat units at the other. To do this job AMC operates the largest business in the country within a framework of legislative and regulatory restrictions that would doom any civilian

management to frustration and bankruptcy. AMC has total assets of \$39 billion—50 billion more than the combined total of the two largest private corporations in the country, Metropolitan Life Insurance Co. and the Bell Telephone System. ► **1954 Business**—Here is some of the business AMC did during fiscal 1954: ► **Spent \$31.4 billion**, of which more

USAF aerial weapons systems: ARDC works in Area B with Weapons System Project Office.

than \$8 billion bought weapons systems and hardware required by USAF. Since the outbreak of the Korean war in mid-1950, AMC has spent \$25 billion to put muscle on the under-extended skeleton of USAF combat wings. ► **Carries contracts** currently on its books with hundreds of American firms for future delivery of \$47 billion worth of USAF equipment.

► **Overhauled 27,500 aircraft engines** and reconditioned 4,512 aircraft. ► **Shipped 44 million tons** of supplies to 300 USAF bases and 1,400 other military installations around the world. ► **Stocked over 800,000 types** of items in depots containing 50 million sq. ft. of storage space. ► **Procured 39 million supply lines** through its domestic and foreign depots.

► **Disassembled thousands** of aircraft to recover parts and materials for reuse.

► **Speed—because** AMC must pull against the widening gap between the longer development cycle required for more complex aerial weapons systems and the increasingly urgent need of combat forces for equipment superior to the enemy's. AMC must also give its support and supply attention to the supporting part of its combat.

► **Economy—because** AMC must get the maximum in air combat strength out of every dollar, machine tool, production worker, pound of material and plant utilized. USAF fears its share of the national resources.

► **Decentralization—because** AMC's job has grown so large and complex that it can no longer be operated from a single spot. And even if it could, the growing threat of long-range enemy air attack makes it militarily unwise to concentrate this operation where a single atomic bomb could obliterate it.

Decentralization is working for AMC—as it has worked before for industry, says Gen. Benjamins. "Our philosophy of decentralization is aimed at maintaining centralized control in AMC headquarters and decentralized operations in our Air Materiel Areas and Depots."

Decentralization of AMC began in January 1952 with the appointment by Gen. Benjamins of an ad hoc committee to study the problem. The committee was composed of senior AMC officers and military experts from USAF headquarters. At last June, AMC was reorganized with the flood of peacekeeping duties that followed the Korean military operations after Chinese armistice in the Korean war.

► **Why Decentralization?**—The immediate factors influencing decentralization were:

► **Critical overloading** of the facilities of Wright-Patterson AFB. ► **Lack of proper technical personnel** in the Dayton labor market in the quantities required by AMC's expanding work load. ► **Scrambling of AMC headquarters** in a tremendous volume of paperwork and tape generated by the flow of all problems from the field to Dayton for solution and decision. ► **Neglect of policy-making** and plan-

wing activities at AMC headquarters in, some of the workload imposed by one-branch staff and operating functions in Dayton.

For the future these considerations were important.

• **AMC required an expensive response to meet future contingencies, and this could not be obtained from the overcrowded facilities at Wright-Patterson AFB in the badly drained Dayton labor market.**

• **AMC headquarters provided too strategic and valuable a target for enemy air attack, with all of USAF's precious maintenance supply and maintenance operations concentrated in the environs of Wright-Patterson AFB.**

AMC's situation started around 1945, largely U.S. industrial expansion, which saw the aircraft industry expand to meet the needs of the armed forces.

At that time, the aircraft industry was such a major force in the economy that it was not until the late 1940s that the government began to take steps to control the industry. The industry had been so successful in its growth that it had become a major force in the economy.

Field Activities—In the first phase of AMC decentralization, the headquarters at Wright-Patterson AFB began peeling off operational functions and assigning them to AMC field or intermediate-level air material areas and the depot. AMC headquarters sought to retain only the functions of policy-making and management control. Under decentralization, the air material areas and the depots retained a more important role in developing AMC responsibilities.

The restructured system became capable of the operating demands of a large



LT GEN BRYANT BOATNER, Deputy USAF chief of staff for aircraft.



ROGER LEWIS, assistant secretary of Air Force, speaking to a crowd.

decentralized private business with all of their functions such as inventory, maintenance, supply, contract, administration and government under a single management that had the authority it required for its particular operations, but working under the central policy and management control of AMC headquarters.

Expected effect of decentralization was felt in the procurement function of AMC where its Procurement and Production Division located in Area B of Wright-Patterson was assigned under a command of paper work resulting from the effort to get the USAF production program in high gear after the beginning of the Korean war. AMC shifted 50% of its procurement paper work to the field organizations, leaving the procurement people in AMC headquarters free to concentrate on the reviewing and most important 25%.

AMC headquarters retained buying responsibility for all aircraft, engines, systems, aircraft engines, propellers and all government furnished aircraft equipment and other highly technical items requiring considerable engineering support. These items accounted for 50% of AMC's procurement dollar volume, but because they are high-cost items they involved only 25% of the paper work.

The procurement authority shifted to the air material areas and depots involved only 25% of the AMC dollar volume, but since it covered a large quantity of strictly low-cost items it generated 75% of the procurement paper work.

AMC field installations were delegated specific authority for handling the procurement of items on the AMC qualified products approved list, standard authorization items and for space parts acquired for continuing support of aircraft and equipment already in service (in distinguished from initial space purchases for new programs that still are handled in AMC headquarters).

Local Purchase—A third method of procurement known as the local purchase policy also has been used. The AMC administrative head by negotiating centralized use of three homecoming supplies from depots with the authority for USAF installation in the field to buy that two homecoming items from standard commercial suppliers. This policy has been operating at many USAF installations and will increase in volume in the future.

Total of 130,000 standard commercial items such as light bulbs, paint, hardware, tools and parts are now authorized for direct local purchase by wing agencies instead of having to flow through the AMC and all intermediate paper work.

Major Procurement—It is obvious that the decentralization of procurement involving 50% of the paper work, had left AMC headquarters more time and effort to concentrate on the most important phase of its buying activities—the purchase of complex and expensive aircraft, engines, systems and their supporting sub-components. It has enabled AMC to accelerate its buying process in the area where production lead time, proper pricing and technical superiority are most important.

AMC headquarters also retains procurement responsibility for aircraft and GFAE furnished foreign countries under the MICAP program and under the reimbursable foreign program that allows approved contractors to buy military aircraft with their own funds at the same price USAF pays.

Central Aircraft Buying

Another reason for the retention of aircraft, engine, propeller and GFAE buying at AMC headquarters is the close physical proximity of the Procurement and Production Division of AMC and the technical laboratories at Wright-Patterson AFB.

Procurement—The extensive support of WACAC is required for AMC's operations. AMC and the Air Research and Development Command have established the joint support activities project in Area B to provide leaders with a single focal point for its contacts with USAF as each possible weapons system during production and production phases.

To decentralize its supply operations, AMC assigned prime responsibility for some 275 USAF property classes to its field units. These assignments were made on a commodity basis. For example, the Cadillac Depot was given responsibility for all automotive supplies. Warner Robins Air Material Area got all aircraft, propellers were assigned to Middlebrook, textiles, rubber, clothing and printing went to Williams Depot, fuel tanks, bearings and new engine were assigned to Moline, Depot. The air material areas also were given prime responsibility for handling the aircraft, engines and parts for aircraft manufacturing. For example all North American planes and parts are handled through the Sacramento Air Materiel Area at Pratt & Whitney. Aircraft parts engines are the responsibility of the San Antonio Air Materiel Area; the Oklahoma City AMIA has prime responsibility for Boeing products.

This gives the wing, aircraft and engine manufacturers a single point of contact as their supply, support and maintenance problems for their contracts must get to the point AMC AIRC responds to their project orders in Area

USAF PROCUREMENT PROGRAM FISCAL YEARS 1953-1954*

	1953 Actual	1954 Planned	1955 Estimated	1956 Estimated	1957 Estimated
1. Aircraft	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
2. Engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
3. Propellers	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
4. Aircraft engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
5. Aircraft engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
6. Aircraft engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
7. Aircraft engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
8. Aircraft engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
9. Aircraft engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000
10. Aircraft engines	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000	\$1,000,000,000

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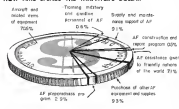
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120. Aircraft engines

*Source: USAF Report
*All figures in this table represent estimated expenditures.

HOW AMC SPENDS THE TAXPAYER'S DOLLAR



MANAGEMENT

of Wright Patterson AFB give them a single point of contact on development and procurement problems.

► **Advantages**—AMC has great faith in the future development of these ideas. AIAA's primary reliance on specific weapons system programs is an effective method of providing the speed and efficiency required to keep a modern aerial weapons system combat ready and motivated to first-line effects even throughout its life as the USAF's main test center.

Under decentralization, the air national assets and depots also compete for USAF requirements and budget data for the major weapons items for prime responsibility, handle all programs accounting for these, control USAF-wide distribution on these items, determine weapon categories and instruct procurement requests.

Applied to AMC's maintenance functions, decentralization has shifted the headline of all contributor reports and publication of technical orders to the air national area or component for which they have been assigned prime responsibility.

Steps to Consolidation

The second phase of AMC's decentralization program began in 1971 and was aimed at elimination and consolidation of intermediate headquarters. Under this phase the following action was taken:

- Functions of the air procurement districts were absorbed by the air materiel areas.
- Six air procurement districts were eliminated.
- Seventh Air Procurement District that was operating experimentally at Middle

town, Pa., was eliminated.

These actions saved AMC as an air national asset of \$400,000 for leased office space and a total of \$250,000 in equipment no longer required. It added the following functions to the AIAA:

- Contract administration for its requests
- Handling plans security clearances
- Supervision of plant representatives offices

AMC REGULATION

Basic USAF regulations defining AMC's authority and mission at 23 Feb Dec 5, 1975. It defines AMC's mission as follows:

1. Provide overall logistical support for all activities and agencies of USAF as well as those additional activities designated by Department of Defense which are dependent on USAF for logistical support including NIDAF.
2. Provide, establish, and control adequate, efficient, up-to-date systems of procurement, production, quality control, maintenance, transportation, traffic management, supply, and disposal for all aspects of logistic support for complete initial weapon system or as requested for the USAF in reserve.
3. Train specialists made for the accomplishment of specified logistic functions in various units and divisions and provide depot-level specialist training for cadre personnel of as depot work and replacement personnel for various depots.

The third phase of decentralization events the transfer to AMC is aimed at further reduction and achievement of its principles involved in Phase I and II.

Studies are continuing at AMC headquarters on the remaining operational area there to determine if further decentralization is feasible and will speed progress toward AMC's goal of an autonomous field operations command to perform specific missions pending but for USAF support with less expenditure of resources.

► **More Consolidation**—Further consolidation of intermediate headquarters is also in progress along with transfer of some responsibilities for more responsibility to the field and shift of more operational duties to the air materiel area.

- In two years the pattern of AMC's decentralization has become clear and it is possible to measure some tangible results achieved.
- Dramatically reduced the flow of paper work between AMC headquarters and the field installation.
- Substantially speeded the flow of AMC's supply system to USAF user commands.
- Transferred some 700 tons of records from AMC headquarters to field installations.
- Established AMC to handle a greater workload with overall reduction in per man.
- Established more effective relations with other AMC and the aircraft industry in procurement, production, modernization and logistical support of major aerial weapons systems.
- Along with the decentralization program, AMC has pushed progress toward its other objectives of speed and economy. These programs will be de-



ARCTIC-BASED F-4E STARFIGHTERS show skills at sophisticated maneuvers of supply network, counting on AMC to keep them flying.

scribed in detail elsewhere in this issue.

- **Reducing** Three-dimensional inventory.
- **High-value programs** By early 1954 AMC had reorganized all of the USAF inventory items into three cost categories and developed a special handling procedure for high-cost items (more than \$500). These high-cost items comprise only 2.4% of the USAF inventory items but account for 41% of its dollar volume. By concentrating major attention on the small quantity of high-value items it is possible to achieve major savings in the most important part of the inventory. Before the high-value program became effective a 16-cent drive got the same basic treatment as a quarter-million dollar jet engine.

- Application of standard life insurance actuarial methods to jet engine life expectancy spans. Major reductions have been made possible in both purchase and overhaul programs for jet engines.
- Project IRAN (inspect and repair as necessary) and SAM-SAC (inspect aircraft modification for Strategic Air Command). IRAN has cut costs of overhauling standard USAF workloads such as C-47s, C-54s, B-25s to a substantial degree while SAM-SAC has prolonged the useful combat life of the B-26 fleet by beyond its normal span and maintained a high degree of combat strength operational during modernization cycles.
- Jet engine airframe field repair program that has lengthened overhaul intervals,

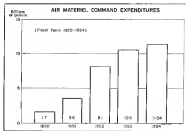
- kept engines operational longer and reduced overhaul costs substantially.
- Development of better production methods such as the heavy press program that enable the aircraft industry to produce better engine parts and cheaper.
- **Speed** Drive-Ahead at more speed are:
- Increasing utilization of direct airlift from supply source to USAF installation for high-cost and strategically critical items such as jet engines, electronic gear and aircraft parts.
- Increasing use of business machines, electronic calculators and computer time systems as a substitute for the time-consuming process of hand-shuffling supply papers.
- **Enlighten, Vital**—The work of the Air Materiel Command looks the cleaner of research and development and less time of the excitement generated by its combat. It is done largely in the paper-shuffling of office buildings, the maintenance of warehouses and the grueling of technical shops. Yet to the leaders of the unimagined revolution that is transforming the AMC drama of "mass Air Force per dollar" from a huge inefficiency, the operation of this gigantic enterprise is an interesting and exciting as it is vital.

These leaders represent a new type of service officer that is emerging from the growing complexity of USAF operations. They are experts of the new science of military management in which they are merging the successful principles of industrial enterprise with the grim details of expense as can best strength.

Some of them, like Gen. Rowlands, have long years of active pilot service blended with Harvard Business School



NORTH AFRICAN-BASED F-4E, rising over desert sands, maintains combat readiness as result of AMC's logistical program.



AIR MATERIEL COMMAND

NORTHEAST AIR
COMMAND

AIR MATERIEL FORCES EUROPE
BUTONWOOD, ENGLAND
NORTHERN AMA
CHATEAUBOUX, FRANCE
CENTRAL AMA
NOUASSER, FRENCH MOROCCO
SOUTHERN AMA

SPAIN AMA

• Air Materiel Area HQ
• Air Force Depot
ADG—Air Depot Group

WEST ZONE EAST ZONE

training and years of experience in management of military materiel. Others, like Maj. Gen. Clarence S. Irvine, deputy commander for production, and Maj. Gen. Clad Bonitt, director of maintenance engineering, bring a heavy dose of combat operations into their approach to the problems of building and maintaining an Air Force in being. Some, like the brilliant Maj. Gen. Philip Smith, who is a graduate of West Point, Massachusetts Institute of Technology and the Harvard Business School, and formerly an Army Quartermaster officer, switched their talents to the Postponing Air Force when it became a separate service. Others, like retired Maj. Gen. Ezra D. McElroy,

temporarily left successful private business careers to pitch into the problems of USAF management.

Industry Studies

Under its current leadership AMIC has borrowed heavily from private industry for its management techniques when they could be successfully applied to the USAF problems. In one field—the use of electronic simulation for maintenance—AMIC is seeking new management ground and experts from industry are traveling to Dayton to see how their methods can be applied to their problems.

Key to AMIC's management approach

is the monthly executive control meeting attended by key staff members, all field commanders and headed over by Gen. Ruskings. Here "management by exception" is the rule with attention concentrated on the trouble spots and areas of outstanding performance.

All AMIC field commanders are used usually as a competitive performance basis. When this competitive rating system began three was a spread of up to 25% in the performance of the top and bottom organizations. Now these percentages are decided by fractional percentages and there is an average spread of less than 5% between the top and bottom. Special trophies are awarded for the six critical areas and depot

leading the pack in each quarter. They are:

- Nelson Telford Award to the AMA having the best performance in procurement and production. This trophy was donated by USAF Secretary Harold Telford in honor of his brother, the late Brig. Gen. Nelson S. Telford.
- Merrill Maigs Trophy for the AMA with the best overall performance, donated by "Babe" Maigs, Chicago publisher and aviation pioneer.
- Road King Trophy awarded the depot with the best overall performance and donated by Gordon W. Road and H. G. King, manufacturers who are extremely interested in AMIC.

In the intense atmosphere of com-

petitiveness that pervades every AMIC installation, Gen. Ruskings sounds a note of warning.

"We in the Air Force must always keep in mind the sole purpose for which we exist," he said. "Our product is striking power ready to go the instant we are attacked. We are in being to prevent a war through strength if possible, to win one if it can't be prevented."

• Chasot "Sage-Coach"—"We and ours (the shadow of war is awful). We cannot agree-cost that fact and we must not make the mistake of attempting to measure a striking force's combat efficiency purely in accounting terms. We must measure our readiness to

invest sufficient strength to achieve an enemy. Consistent, comprehensive measures are essential to such competition.

"But it takes a high level of morale and spirit as well as the right equipment to make a knockout lightning force. "We must not have the cost in people by attempting to make bookkeeping of fighting men or to insist on petty economies at an ultimate cost in combat efficiency."

"The next war could be decided in a matter of hours or days. In all our thinking and planning we must never lose sight of this possibility. We cannot put a price tag on those days because they are a precious national treasure, literally beyond price." ■ ■ ■

Headquarters Air Materiel Command

The men who manage the
world's biggest business



COMMANDER
Gen. A. W. Swearingen



VICE COMMANDER
Maj. Gen. V. F. McKee



DEPUTY COMMANDER FOR INSPECTION
Maj. Gen. E. S. Brown



INSPECTOR GENERAL
Maj. Gen. E. C. Cook



OFFICER
Maj. Gen. E. J. Tamm



CHIEF, SPECIAL WEAPONS
Maj. Gen. E. C. Cook



EXECUTIVE
Maj. Gen. E. J. Tamm



OFFICE OF INFORMATION SERVICES
Maj. Gen. E. C. Cook



CHIEF, MAJOR EQUIPMENT
Maj. Gen. E. C. Cook



CAPTAIN
Charles D. L. E. Baker



SAFETY TRAINING
Maj. Gen. E. J. Tamm



CHIEF, SPECIAL EVENTS
Maj. Gen. E. C. Cook



CHIEF, EQUIPMENT
Maj. Gen. E. C. Cook



ASSISTANT, MAJOR EQUIPMENT
Maj. Gen. E. C. Cook



ASSISTANT
Maj. Gen. E. C. Cook



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Maj. Gen. E. C. Cook



HEADQUARTERS OF SUPPLY AND PLANNING
Maj. Gen. E. C. Cook



HEADQUARTERS OF MAINTENANCE
Maj. Gen. E. C. Cook



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SACRAMENTO AMA at McClellan AFB. AMC's distribution for entire Pacific area, replaces ANA's new role in decentralization.

AMA: Supply at the 'Grass Roots' Level

By William J. Conklin

Sacramento, Calif.—Decentralization rebores Air Materiel Command headquarters at Dayton of a lot of operational problems.

These problems, unfortunately, do not just disappear. Decentralization means merely that they have been sent somewhere else.

The somewhere else is the right AMC Air Materiel Area and seven supply depots.

Decentralization of AMC functions, together with emphasis on the weapon system concept, has brought added importance to these AMAs.

The Air Materiel Area, once only a supply depot for Air Force bases within its geographical area, now has acquired new important responsibilities.

► **Final Jobs**—When Brig Gen William J. Heflin, commander of the Sacra-

mento Air Materiel Area (SMAMA), looks at a map, he can define the few areas of his responsibility geographically. For example, one encompasses a zone which covers more than half of the U. S., and the fourth is a region which includes Northern California, Northern Nevada, and the state of Oregon.

Under decentralization, each AMA is charged with:

- **World-wide logistic support** required by assigned weapon systems
 - **World-wide management** responsibility for assigned weapon systems
 - **Final responsibility** for certain major depot duties
 - **Special logistic support** within the AMA's assigned geographic area
- Since one of AMC's four Overseas Logistics Control Agencies falls under his command, Gen. Heflin also has a 64th responsibility: the distribution of Air Force supplies to the entire Pacific area, including such hot spots as Korea and Indochina.

AMA's Big Jobs

With the duties of each Air Materiel Area varying somewhat, no AMA can be said to be fourth in all of the seven. But the Sacramento Air Materiel Area at McClellan AFB, one of the largest, serves as an example of the new role the ANA is to play in the decentralized MAC representation.

Incidentally, MAC all alphabetized government agencies which lend themselves to the practice. AMA has become a word in the AMC language, usually pronounced by rhyming with "news."

► **Prime Responsibilities**—Each AMA has been engaged prior responsibility for the products of one or more of the aircraft or engine manufacturers.

The Sacramento Air Materiel Area, for example, is proud to be the product of North American Aviation and Lockheed Aircraft Corp.

For the operational commands, this provides a single point directly responsible for logistic problems of their aircraft. The AMA base at McClellan AFB works closely with the Air Materiel



LEAVING SMAMA, recovered planes are loaded 10 miles, then hauled to San Francisco evaluation point for ship loading.

Command, for instance, where most ADC aircraft are built by North American and Lockheed.

For the aircraft industry, this recent clear cooperation from the Air Materiel Command organization specializing worldwide in the problems of the individual manufacturer.

Under this concept, for example, SMAMA is responsible for seeing that whenever the F-100 is operating in the world it has full logistic support for all components from the time of its first test flight until it is declared obsolete.

Therefore, while SMAMA does not have prime responsibility for the engine which powers the F-100, it must see that the AMA which does have the prime support responsibility is prepared to provide proper logistic support for the North American aircraft.

- **Weapon System**—The Air Materiel Area has been assigned these specific responsibilities for its weapon system:
 - **Assigning AMC headquarters** in the development of logistic support concepts for assigned weapon systems
 - **Maintaining planning charts** showing dates for accomplishing support actions
 - **Assigning logistic support actions** to all AMC activities for its assigned weapon systems
 - **Solving any problems** of assigned weapon systems

When the Air Defense Command found that performance of its North American F-100s and Lockheed F-104s was not as high as desired, it came to the Sacramento Air Materiel Area with its problem. Together with ADC and the manufacturers, SMAMA worked out an extensive modification program, now underway.

Although some of the modifications involved changes and the material equipment on which other AMAs are prime, the Air Materiel Area here was charged with seeing that these problems on its assigned aircraft were worked out.

► **Assigned Property**—In its second area

of responsibility, the AMA has prime responsibility for certain assigned property classes, such as weapons fuel loads or electrical generator sets.

On these items the AMA is responsible for comparing requirements for growth and type status needed, for their procurement and production and for contract administration. It also must evaluate modification requests (MRs) and engineering change proposals (ECPs), as well as prepare technical orders and maintenance handbooks. The AMA must determine repair and modification requirements and schedule that workload to specific depots or contractors.

► **Final Responsibility**—For the purpose of assigning and responsibility, AMC has divided the U. S. into centers and

western areas. On property classes for which it has prime responsibility but for which an AMA in the other zone may be prime, the Air Materiel Area is charged with depot maintenance, storage and distribution, but accepts the management functions.

Local Support

The list of the four functions goes back to the original concept of an AMA—that of logistic support for the geographic area in which it is located. The AMA provides Air Force bases in its area with supply and maintenance support. If a problem arises where special assistance is needed, the property classes or weapon systems which are the prime responsibility of another AMA,



FAR EAST ROUND F-105 Meeting is underway as part of extensive preparation for shipment.



LOGISTICS MAP at overseas monitoring office shows supply flow to Pacific and Asia.

man, and any other agency, or, if needed, to select the total logistical effort to do correctly for which we are just responsible for all logistical planning in connection with its general mission. Working from the production schedule, it must develop support schedules to provide guidance on other depots involved in support of that aircraft, such as the engine depot. The prime depot is responsible for seeing that these schedules are met.

And, of course, the AMA must provide spare parts support for that prime aircraft. First advice of production for spares is generally made 24 months in advance of the delivery of the first aircraft. The AMA also controls the allocation of all spares and the quantities which are to be produced.

The Air Material Area also is responsible for action on construction reports on its prime aircraft. Engineering change proposals are received from the contractor through the prime aircraft depot. Thus, the AMA's work with the engine commands and the manufacturers to keep their prime aircraft in top-to-date as possible.

It must work with the same commands to determine the logistic needs based on the flying hours scheduled. It develops support plans for field maintenance. The plan for the F-16B, for example, calls for every regular repair at major assemblies in the field while the aircraft is overseas. Thus, to support the plan, SMAMA will make some assemblies there report parts.

The Air Material Area also develops plans for depot-level maintenance support. Col. Lockwood's BC 121, which will be flying on regular order pilot schedules for Air Defense Command, is an example of this maintenance plan was worked out which will cost less.

Col. AMC DC B7-7: The AMA also can determine whether AMC is logistically capable of meeting requirements cited by the operating commands. For instance, North Americans recently tested engine air command losses to demonstrate the T-28B.

If a command asks a requirement for that aircraft, SMAMA is ready to put AMC or USAF headquarters with a study of the logistical requirements needed to support the T-28B.

This study had to take into consideration such factors as possible costs for old magazines and old personnel and cost of aircraft modifications required for carrying T-28 aircraft. It required working with the engine depot at Middlebrook to determine the capability of converting to the Wright R-1820 engine.

The completed study sets forth the amount of money needed to accomplish the conversion, as well as a proposed conversion schedule which could be handled by all the AMC depots which would be involved in such a program.

► **Support Schedules**—Although the AMA is not responsible for scheduling of production for which we are just responsible for all logistical planning in connection with its general mission. Working from the production schedule, it must develop support schedules to provide guidance on other depots involved in support of that aircraft, such as the engine depot. The prime depot is responsible for seeing that these schedules are met.

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Planning Ahead

The AMA also works out IRAN schedules with the prime commands. To do this, it must consider the flying requirements, when the wing commander can spare the aircraft, the contractor's maintenance on time between overhaul, as well as availability of overhaul facilities, either within the AMC system or at contract facilities. Requirements of such diverse factors require careful planning.

► **Planning Experts**—In fact, skilled planning has become one of the most important functions of the Air Material Area commander. To meet him, he has the office of the Assistant for Programming, who is responsible for the flow of requirements of such elements of the command as the Maintenance, Supply, and Procurement directorates. Since these directorates depend on common programming data to develop their own plans and schedules, the Assistant for Programming can see also as the single point of contact within the AMA for involving and disseminating program information. This office also is responsible for monitoring the implementation of weapons system concepts by the directorates responsible.

The job of the Assistant for Programming, as the words of John M. Wynne, who serves Gen. Hickey in this capacity, is to be the general staff for the planning area. If the dates of Wynne's 25th anniversary were coincided in one word, it might be coincidence.

The importance of this office may be seen with such AMA. Col. Hickey believes in delegating responsibility to

obtain the maximum assistance possible from the management staff. Elsewhere, another AMA commander might wish to act as much of the planning under direct control.

► **Keep on Thinking**—Gen. Hickey also has another group which aids him in carrying out his command responsibilities under decentralization and the weapons system concept.

Each with the base comes a report on any of its prime aircraft throughout the world which are out of commission due to lack of parts (ACOP) or are not fully equipped for their mission (ANFR).

The general has reported a top-level committee to study these reports and take any action necessary to correct the situation.

"They got it to prevent a \$3-million aircraft from sitting on the ground for lack of a two-bit part," he says.

The commander, backed by the AMA inspection group, facilitates requirements from the maintenance, supply and procurement directorates, and from the weapons systems office and the office of the assistant for programming.

Gen. Hickey has found this top-level conference an excellent method for shortening some of the functional lines of his command and breaking barriers.

AMA Directorates

To carry out its duties, the Air Material Area is divided along functional lines into three directorates: Maintenance, Supply and Procurement.

► **Maintenance Directorates**—Largest of the three is Sacramento is Maintenance, with 9,200 people under Col. Arthur C. Perry. Its long assembly line can handle up to 240 aircraft of varied types per month in major overhaul.

The Maintenance directorate is run in better drive into such branches as electronics, armament, engines and accessories.

Decentralization has been a boon to the maintenance shops, Col. Perry reports.

"Decentralization is a big help because we have control of the workload here now and we can eliminate the feedback—we can schedule a fix, usually workload into one shop," he says.

Due to this control, the maintenance workload for Sacramento for fiscal 1975 already is cutting fast.

Decentralization also has brought added responsibility, of course. As many as 1,500 construction projects for maintenance are now planned here each month.

"But we can analyze those better and faster and take corrective action faster than before," Col. Perry reports. "This

speeds production line changes as well as activity."

Engineering change proposals from the manufacturers also are evaluated here, although requiring Wright Air Development Center approval. Thus, aircraft IRAN and maintenance programs often can include design changes that those suggested by the wing command through UIC and resident reports.

"We are concerned with having the best product possible for our customers," is the way one AMC official puts it. A large part of that concern falls on the Maintenance directorate.

► **Supply and Procurement**—Supply and Procurement is a somewhat different cut of the business from Maintenance. If you ask a Supply man about the Procurement directorate, he will tell you it is a "hot" which Supply uses to buy the goods needed by its customers—the operational commands.

It may not be Procurement was about Supply, he will point out that Supply is a "hot" used by Procurement to transport the goods to Procurement on

mission—the operational commands.

Either way, it is apparent that both cut for the benefit of the customer, that then joint task is to supply the major commodity with the logistic support necessary to keep them in operation—whether it is a risk of step or a jet engine.

Field Support

Both Supply and Procurement differ from Maintenance in that their main function is off-base. The major function of Maintenance takes place right at McClellan AFB. But Procurement gets wherever to buy what is needed and Supply delivers elsewhere. Only at the warehouse stage—in what might be called its business line—procurement sends checks to supply customers in its field base.

It is hard to quantify, however. More than 250,000 items are stockpiled in McClellan's own warehouses.

► **Supply's Job**—Under decentralization, Supply, which at SMAMA is under the

ENG. GEN. W. T. HUBLEY
Commander, Sacramento AMA

the Air National Area can call upon the other AMA to assist with the problem. The AMA is responsible for taking any Air Force logistic problems within its area. This includes Research and Air National Guard activities.

► **What It Takes**—What does it take to carry out all these functions?

At McClellan AFB, it takes an AMA which covers 2,000 acres of shops, warehouses, hangars and administrative buildings. It requires 15,000 civilian employees and 800 AMC officers and airmen.

It takes a total of \$65.5 million annually and a personnel complement of 5105 civilian employees. It also requires an organization which expends \$150 million annually to meet Air Force requirements in its prime areas.

SMAMA operates as one command—15 of which, with those locations. Someone has figured out that the paved run on the base is the equal of a three-lane highway from Sacramento to Reno, that the base telephone system handles 1,000 calls per day, that the base can enough wiring each day for 15,000 homes, and that there are 2.2 million sq. ft. of warehouse storage space.

All of this for the one purpose which an AMC official calls "customer service"—to provide service to AMC customers, the operational commands of the U. S. Air Force.

How It Works

Basic reason of the AMA under the weapons system concept is to support logistically the operating commands with respect to the aircraft and other weapons for which the AMA is prime.

How does this work, when a command comes to the AMA with a problem is our coming its aircraft?

An SMAMA spokesman describes the operation this way:

"We divide up the supporting depots, the engine depot, the control depot, the engine depot, and the support equipment depot, as well as the contractors. Air Research and Development Command, Air Force Command Center



PISTON ENGINES for USAF aircraft flow through AMA maintenance workshops.



TECHNICIAN REPAIRS light loads from Pacific area, a SMAMA responsibility.



CONTRACTORS' tools up, down here in Korea, plus field duty on AMAs.

direction of Col. E. L. Renner, is charged with both aerial support and follow-on support of its assigned wing air systems and other prime equipment.

When this division is asked to buy new or additional aircraft, the group depot holds a planning meeting to decide what spare parts are required to support that aircraft for one year in service. These are delivered with the aircraft. This is known as initial support.

After the aircraft has been in service, Supply reconstitutes the parts that recent experience has indicated will be needed by the number of flying hours projected for the aircraft. It also Procurement to buy these. The wing commander then requisition these parts as needed. This is follow-on support.

The group, based at Hahn Air Base, operates on requisition. When commands in the AECM operate on 45-day supply basis, the depot is on a weekly basis. Present supply requisites at MacDill are estimated at 5000 orders.

Supply has the responsibility of seeing that the USAF commands have everything they need to exist and accomplish their mission. This supplies do not always come from Air Force channels. The Quartermaster Corps is expected to supply food for the Air Force, for example, and USAF obtains its 45 either orders from the Air Force. They supply via two different tools to fill its responsibilities. In one case, it uses its own procurement branch in country, it may have to another service. In each instance, however, Supply must coordinate the needs.

As noted above, to fulfill its global responsibilities under the support systems concept, this depot is kept

formed of every item which is present in one of its prime aircraft down to the smallest screw in the world. Whether this is due to damage of an item or a malfunction, the AMA takes whatever action may be necessary.

"The wing commander is putting the support into total depot service," reports a Supply officer. "It is a definite improvement."

Link With Industry—The Procurement director, under Col. H. H. Tullman, is SMAMA's main link with the outside industry. This officer is responsible for purchase of such items as North American and Lockheed spares, as well as the handling of contract administration, checking of quality control and monitoring of production schedules.

The director has four divisions:

- Procurement.
- Contract administration.
- Production.
- Quality control.

It also has prime staff responsibility for the Air Force plant representative offices at Lockheed and North American, for the San Francisco Air Procurement District, and AMC's Philadelphia office.

Of the 500 director's employees, 300 are stationed elsewhere. The plant representative's office at North American has 140, at Lockheed 120.

The director's procurement division spent \$45 million last year, 510 million of a one installed local purchase items which AMC permits its units to buy in their own geographical areas. The rest went for North American and Lockheed spares, prime items such as fuel tanks and printing equipment, and tool maintenance contracts.

Procurement Manager—Lt. Col. G. E. McQuinn, Jr., is the procurement director. He is responsible for merging them with the Air Materiel Area. The Western Air Procurement District, for example, was set up last year with one section assigned to the Sacramento Air Materiel Area and the other to the San Bernardino Air Materiel Area. The former regional office in San Francisco and Los Angeles was in moved "procurement district."

AMC then consolidated two of its field organizations, the AMAs and the procurement districts. Although a consolidation rather than a decentralization, the move led into the pattern of increased responsibility for the Air Materiel Area and at the same time eliminated a number of administrative overlapping functions.

It also brought the field procurement organization into closer contact with the depot operation, resulting in improved relations with such AMA functions as supply, maintenance and procurement. It has resulted in what one official calls "a decentralization which benefits everybody."

Although the San Francisco Air Pro-

curement District, like the plant representative and Philadelphia offices, falls administratively under the Procurement division, it reports directly to AMCA headquarters.

Contract Watchdog—The director's contract administration division is responsible for administration of all AMC contracts in this area, regardless of what AMC depot does the actual buying. In addition to administering the contracts for its prime North American and Lockheed aircraft, it also is responsible for subcontracting contracts which the Rome depot, for instance, might sign with an electronics manufacturer in San Francisco.

This division is charged with such functions as supervising the cost system of the contractor, approving his buying procedures on cost-type contracts, seeing that government furnished property is accounted for properly, insuring that the contractor is paid, and drawing up termination agreements at the end of the contract. It also handles some phases of price readjustment when necessary.

The director's production division is responsible for seeing that AMC contractors meet their production schedules. In this, it must be certain that the contractor gets the proper priorities and that he is getting the right type and quantity of government furnished materials, if called for in the contract. One of the important duties of this division is planning for industrial needs in event of an emergency.

Quality Inspector—The quality control division maintains a surveillance type control. In World War II, the Air Force suspected almost every thing the contractor supplied.

Now AMC sets up the inspection plan and then spotchecks the operation.

Decentralization Work—This is decentralization and the support systems concept work at the Air Materiel Area level. First, according to Gen. Hefner, and further decentralization of existing functions can be expected. "It has resulted in better personal relations with the contractors, he says, and more attention to the contractor's problems."

"We are able to put a higher level of talent on major problems," Gen. Hefner reports. "It is no longer a problem among stars as it was at Wright Patterson." The system points problems in this manner, just as it permits responsibility for each wing its actions.

"This does not mean that the 'bean' is cut off from the rest of the system. But most of the complaints heard here concern the need for more decentralization, not less. The AMA seems to be turning on the new role which gives it increased responsibility and importance in the AMC organization."

Although the San Francisco Air Pro-

AMC FIELD ORGANIZATION

The Men Who Make Decentralization Work

AIR MATERIEL AREAS



WILLIAM E. HEFNER, JR.
Maj. Gen. U. S. Air Force
Chief of Air Materiel Area



JOHN M. HEFNER, JR.
Maj. Gen. U. S. Air Force
Deputy Chief of Air Materiel Area

COMMANDER
Gen. H. H. Renner



AIR FORCE DEPOTS



WILLIAM E. HEFNER, JR.
Maj. Gen. U. S. Air Force
Chief of Air Materiel Area



JOHN M. HEFNER, JR.
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Deputy Chief of Air Materiel Area



LOWER-BODILY PLANNING, notes of the day under distribution, with frequent depot management model meetings.

How AF Operates Huge 'Hardware Chain'

By Gordon Conley

Topolex-Air Materiel Command is operating the world's largest chain of "hardware stores," each doing a multimillion-dollar business. But they serve only one customer—the U. S. Air Force.

Across the country, AMC's seven Air Force depots each handles an estimated 10,000 to 20,000 tons of aircraft spares and military "housekeeping" maintenance monthly for domestic and overseas USAF units.

In the backrooms, they assemble kits that would allow Strategic Air Command squadrons to take off entirely on reduction strikes and operate as self-supporting units for at least 30 days. The depots also prepare supplies for AF units to be turned in one to two years and forecast the amount of spares and equipment a new aircraft will need two years before the first model becomes operational.

■ **Along the Fat-Strawlers** are usual Air Force Civil Service teams, who are making up a new book of rules and income statements on industry supply systems as they go along.

■ In the past four years, these teams have taken over from AMC local quarries at Dayton the responsibility for determining USAF's requirements for private stores assigned to each depot.

■ Six months ago, Topolex AFD, Kees, and Malley AFD at Memphis, Tenn., began experimenting with a single depot concept designed to make one institution, instead of the previous two,

responsible for procurement, storage and world-wide distribution of certain non-combat materials.

Such integration in distribution of Air Materiel Command headquarters' procurement authority and the single-depot concept resulted from AMC's search for ways to slash unnecessary fat from its operations.

To aid this effort, Air Materiel Command headquarters gives its depot teams a working flexibility similar to that of private industry and encourages field personnel to use retention, integration and exchange of ideas on how to set up a more effective support of the Air Force program.

"We're still on the alert for additional jobs at headquarters that should be transferred to the field," says one depot official.

AFD Reorganization

Prior to 1958, AF depots were responsible only for storage and distribution of supplies. AMC headquarters at Dayton determined USAF's hardware needs and made all purchases.

■ **Modern Management**—As one long-time AFD employee puts it: "We had

shorter management with respect to dissemination of material requirements. Important decisions were being made elsewhere far up."

Under decentralization, depots now receive the Air Force program each fiscal year from AMC HQ, determine quantities and requirements, draw up purchase requests, call for bids and let contracts.

Each depot holds world-wide responsibility for its prime contractors. Decentralization increased the efficiency of AMC's hardware procurement and supply system by letting depot personnel, familiar with the needs of the field, complete USAF's requirements.

It also shortened the supply chain by cutting the length of time between dissemination of needs and delivery of materials to warehouse bins at each depot.

One major accomplishment to AFD workers: Depots now have command status within the AMC framework. "And because of that," says Lt. Col. C. J. Papp, Topolex, Director of Supply and Services, and acting commander, "we have a closer knit sense of responsibility."

■ **Ball Section's Idea**—The single-depot concept was proposed after a "ball section" of depot officials—AMC tentatively approved the idea, told Topolex and Malley to begin a test last March. Before the single depot experiment, private stores handled by Topolex were

distributed in Malley's test for the depot to USAF units out of the Mississippi River. Topolex stored Malley's private commodities in addition to its own, handling all requirements from the west.

The two Air Force depots now share common stores, each holding world-wide responsibilities for its principal stocks.

"One depot can operate with a lot less stock than previously required for both Topolex and Malley," Papp says. "It was finally convinced that will result in dollar savings and increased efficiency. It will cut transportation and warehouse costs and give better utilization of trained technicians."

■ **War Preparedness**—In addition to handling prime commodities, each depot has started working on AMC's Readiness Reserve Program—no "warehouse supply system" set up for immediate support of USAF units if another war should break.

"We recognized that we must have logistical supply packages ready to go immediately," says R. J. Pappert, formerly on AMC's Dayton staff and now deputy director of Supply and Services at Topolex.

These include spare parts for SAC squadrons and air transportable field depots assembled to open for business quickly after a full delivery. Some are ready to go now, a few would take 24 hours.

"We are working toward having everything done—except filling in the address," Pappert says. "The program is not food or fuel, it is undergoing constant review to fit with plans of the Pentagon level."

Readiness Reserve also includes preparing ahead to supply new organizations still to be activated by the Air Force—"that really equal to war plans," according to one depot worker. "Forming requirements for each the smallest unit requires a fantastic amount of detail," he says.

■ **Produce Kits—Order in Readiness Reserve** text, Topolex has a Special Project Branch to assemble special kits "possible" to the Air Force. The operation is the only one of its kind in the country.

Technicians select the weight and cube of material packages and acid them down assembly lines to be made up into small, air transportable containers and disposables. Typical differences between these kits and normal equipment are instead of beds, a flexible mattress and pillow rather than weight, inflated types.

An Materiel headquarters set up the project after SAC found kits actually packed by military personnel for use were cumbersome and heavy, and dislodged light, standard packages were needed.

■ **Production Reserve—Another AF depot test, based at Topolex and Clark, is a project set up to supply plane builders with government-financed aircraft engines (GFAE).**

In this division, Topolex and Clark stockpiles build up stocks of various systems, radio and solar sets, flight instruments, propellers, some engine components and other standard USAF aircraft equipment bought in volume by AMC for plane makers.

The two depots cut their stocks to 10 supply gaps when vendor production fails to keep up with aircraft assembly lines—certain situations are already covered. They include Topolex backing up producers out of the Rocky Mountains and Clark supporting the west.

As one project official comments: "It can be expensive if an area is needed in an impulse out of assembly line sequence. We try to make sure it isn't necessary."

Thus need for a constant flow to aircraft production lines matches past present on the depots' second

regularity repair of equipment replaced by the aircraft builder. Topolex and Clark do little spare work at the depots, most stock designed and stocked prior to commercial construction.

Repair responsibilities are one of the most important functions of the GFAE project because assembly-line support equipment is bought on the basis of one part per one aircraft, with no inventory for spares at launch.

And AMC wants the equipment on hand 90 days before it is scheduled for installation.

Depot Operation

At Topolex AFD, one of the top hardware stores in Air Materiel's chain, the Air Force-Civil Service teams do business within sight of users of the aircraft they support. 45% take all across the road at SAC's Fort Belvoir.

Stored in Topolex's 15 huge warehouses are assets totaling approximately 5179 vehicles. More than 200,000 of the AFD's prime contractors' and commercial hardware, special tools,



ENGINE STORAGE LOT at Topolex shows combat engines ready for combat units.



TOWNEVER: Depots receive items from better storage warehouses at Topolex.



DEPOT STORAGE, using the bin pallet method, gives best use of space.

new materials, chemicals and parts are processed at this installation each month.

As our stockpiper informed, "I'll bet even Sam Rainsford at Montpelier Ward doesn't handle that much."

► **ABD Control Ball**—Center of the depot's operation is the Mutual Control Division, where workers forecast the number of aircraft parts handled by Topolka that a new aircraft will need for a period of 173 months after the first operational model comes off the assembly line.

There is no magic in this crystal ball. Forecasts are calculated from cold, hard figures on consumption of the prototype plus recommendations from the aircraft developer. There are given a consolidated working order with a breakdown by Depot personnel. This is called "forecasting"—one of AMC's hardest jobs.

From the aircraft's performance during the initial support period, Mutual Control compared the number of follow-on parts required for five plane's USAF life.

Topolka asks for bids on those items, then lets contracts.

"This division does the quote and award work," says Kenneth Rutz, deputy for management and procedures. "Then they control Topolka's stock workbooks, including needs of the Mutual Defense Assistance Program."

► **Primary Mission**—After contracts have been let and hardware begins flowing from the vendor site, Topolka's stockpilers turn to their primary mission: logistics support of Air Force units.

Topolka's Col. Philip emphasizes speed in handling each requisition from a USAF base.

On priority requisites, stockpilers have 12 hours from the time a requisition is filed by teletype or telephone to fill the order and put it out the depot's door to the inventory inspection area. And the routine requisition process is the same, they are allowed a maximum of five days.

Philip says: "Keeping these orders in a simple, step process set up for fast but careful handling."

A status update from Edwards AFB on 15 January called attention to a unit from the mail and distribution department to the depot's office unit, where it is given a preliminary check and assigned priority. From there the requisition goes to the vendor unit and straight to an AFD control mailbox.

Mutual Control assigns the order for availability and, of 25 class code assemblies are in Topolka's bins, order the requisition for shipment. Logistics Staff goes the order, tabulating the number from the depot's assembly bin. The requisition goes then

moves up the number of order copies needed for shipping.

In the warehouse, the order is pulled and sent to transportation, where they work are consolidated into orders to cut costs.

Watching over the operation is Michael Control's operations section making sure the prime consideration listed on Topolka's assembly agree with the number stored in the warehouses.

► **AFD Country Store**—For its own supplies, Topolka usually set up a "country store" of housekeeping supplies purchased from manufacturers in the area. "The local purchase program enables us to share our experience of most AMC contractors, it's like the general store of a small town."

Depot departments buy their supplies on a dollar basis, cutting operation costs through elimination of paper work and reduction of man hours.

Despite the economy of this operation, Topolka officials say they never will turn to local purchase for technical items, such as even the smallest bolt needed in USAF's aircraft program.

"A bolt 1/8" or 1/16" in size may not be as important as a wing," says Rutz. "A nut or bolt with lead time as it could prevent an entire type of aircraft. As long as it's in our bin, we've got it when we need it."

Some Depot Responsibilities

► **Genie AFD, Dayton**—Assemble and test major equipment and accessories: parts, lubricants and they test inspection equipment and parts.

► **Topolka AFD, Kansas**—Aircraft and commercial hardware, specialized tools and equipment for engines, engines, propellers and component and engine maintenance systems, methods and component materials, chemicals and parts.

► **Wilcox AFD, Shelby, Ohio**—Aircraft and engine equipment and special maintenance parts, rubber engine, tires and inner tubes, auxiliary engines and special purpose shipping, AF publications and technical orders.

► **Wilcox AFD, Missouri**—Production and test power hand tools, test fixtures, bearings and parts, other supplies, equipment and parts, building materials.

► **Kenn AFD, N.Y.**—General assignment: radio systems and parts, ground cable and radio equipment plus motor bus units and parts, runway lighting, commercial electrical supplies, electronic equipment supplies and parts.

► **Wilcox AFD, Ala.**—Packaging and material requisition, testing and planning equipment, functions and functions.

► **Wate French**—When hardware in Topolka's bins no longer is in demand by USAF, the depot forwards it out of the warehouse to other markets through the AF's depot department. These include obsolete equipment, parts that are cheaper to replace than repair, and unsalable materials.

On contracting, stockpilers say they are forced to take a calculated risk. They lose a few of these items on future AF demands.

More than 50% of the unsalable items are given to federal and state institutions or to organizations such as the Red Cross. The rest are sent to Topolka's salvage yard and sold for scrap.

One stockpiler says of the operation: "This is one of those places where you're damned if you do and damned if you don't. If we sell them below cost or give them away, we're wasting taxpayers' money. If we keep them in the warehouses, it ups the cost of the depot's operation because warehouse space and overhead cost money."

Supply's deputy director, Porteous confirms this said in regard of obsolete equipment to keep the depot running on a dollar-and-cent basis.

"Taking care of the material costs 25% of its value each year at minimum in our bins," he says.

► **Economy Targets**—This businesslike approach also is apparent in other Topolka operations.

The depot's workload that up after war broke out in Korea, continued its sharp climb after 1970 and nearly doubled during the last quarter of fiscal 1984. But the personnel managed to do the job by dropping:

► The ability to do more work less. It was led by Lt. Col. Pugh, at daily conferences with his department chiefs. If these meetings fail to come up with a satisfactory answer, a report is sent to AMC's Division headquarters and even depot in the hardware store chain works on the problem until it is solved.

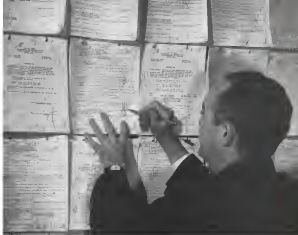
Two simple projects that came out of Pugh's daily management meetings:

- After starting an inspection shift, cut 375 persons from the AF's payroll in one year, dropping the workload for the most part by not replacing employees who quit or retired. Few were fired.

► And as did the in the face of demoralization, which increased one responsibility, the closed unit.

► Converter belts taking the 15-man team with a staff of 820,000. It would approximately \$215,000 in operating expenses during the last eight months of operation.

So we made \$15,000 in less than a year and the Topolka room and repair unit is using an about \$30,000 a year.



CONTRACTOR CHECKS AMC inventory to bid lists posted in Dept. B, Procurement Division Bldg. at Wright-Patterson AFB.

■ PROCUREMENT

AMC: Multi-Billion Buying Operation

As Materiel Command has responsibility for procurement of all equipment and supplies required by USAF. It retains at AMC headquarters authority for buying all aerial weapons systems, supporting systems, subsystems, government-furnished aircraft equipment and other highly technical items. AMC has also delegated specific portions of its procurement authority to:

- **Air Materiel Area** and depots for specific commodities listed under decentralized procurement.
- **Air Research and Development Command** for basic research, armament and electronics development and general aircraft design studies.
- **USAF bases** for standard commercial type house-keeping items.

By next June, more than \$28 billion will have flowed through AMC procurement channels for USAF aircraft and related equipment since the on-

break of the Korean war. Today AMC has contracts on its books calling for delivery of \$17 billion worth of USAF equipment in the next year and on-call.

Decentralized procurement operations have eased the strain on AMC's most important procurement job of buying billions of dollars worth of new aerial weapons systems. The task of weapons system buying has grown tremendously due to increasingly complicated technology and the increased scope and complexity of production programs.

To do this new job faster and more efficiently AMC, working with technical assistance of AIRDC, has evolved new patterns for conducting its business with the aircraft industry and the Air Force commands that are the ultimate users of the new weapons systems. These changes are detailed in the following pages.

Typical Weapons Systems



BOEING B-52 STRATEGIC BOMBER



MARTIN MATADOR MISSILE



DOUGLAS RB-66 TACTICAL RECONNAISSANCE



CONVAIR F-102 ALL-WEATHER INTERCEPTOR

■ PROCUREMENT

Industry-AMC Partnership Tackles

By Claude Wiese

The American aircraft industry today carries the greatest responsibility ever vested in private enterprise.

It is a full portfolio of the United States Air Force as a program to supply combat units with the tools of war, moved from development to operation with maximum speed and economy.

USAF needs far more than the mere airplane with simple gadgets flown in World War II.

Today it buys a weapons system, designed as "an article together with all the related equipment, both airborne and ground based, the skills necessary to operate the equipment and the supporting facilities and services required to enable the instrument of combat to be a single unit of striking power in its operational environment."

USAF-Industry Team

With this definition, USAF draws together the team on which America relies for air defense and striking power. On this team are:

- The Air Materiel Command, which buys, maintains and supports weapons systems.
- The Air Research and Development Command, responsible for technical supervision of weapons system from

the design study to the combat article.

- The operational command, such as Strategic, Tactical or Air Defense, that uses the weapons system.
- The aircraft industry, or weapons system contractor, who develops and produces the weapons, guided or piloted.

There never has been a time in history when a nation put so much reliance on non-government agencies. The change has increased in direct proportion to the growing complexity of modern aircraft, the same complexity that has turned an airplane into a weapons system. This complexity requires a change, all the way from basic research to the operation of a bomber or the launching of a missile.

• **Weapons System Challenge**—With the weapons system concept, USAF has challenged the aircraft industry to provide all of the intricate devices needed to perform as an mission, making sure they are integrated so that nothing is missing or out of order or

blatant loss. The challenge is stated in USAF Reg. 709.

"Going to the successful technical complexity of present day aircraft and equipment, the increasing accuracy of obtaining vulnerability and integration of the various components within a weapons system and the ever present necessity for expedition, orderly and economic conversion from the development phase to the production phase, the normal practice for the Air Force will be to accomplish weapons system development through weapons system contractors."

The weapons system comprises such items as propulsion, navigation, fire control, bombing, radio communication, photography and instrument systems.

Industry's Role

A weapons system contractor is needed to integrate all these things because USAF leaves the job to the capabilities of its own personnel.

"We simply didn't have enough systems engineers in the Air Force," says one AMC official.

Closely related to the complexity of a weapons system is another major USAF headache: the need for economy or "bang Air Force per dollar." Here

Aerial Weapons Systems Complexity

is a round robin for existing industry's help while a weapons system is approaching the design stage. It will bring more efficient use of the manpower and facilities owned by industry.

May Gen. David H. Baker, AMC's director of procurement and production, points out that the old war and head brought out only a few dollars. But the APQ-45 radar system used in today's fighters is worth \$40,000.

And the Norden bombsight had a price tag of \$5,000 against something in the neighborhood of \$200,000 for a modern electronic bombing system.

The prerequisites for the F-86 fighter cost more than a complete F-8 Thunderbolt and in World War II.

• **Time Cost Is Higher**—In addition to more money, these items now cost more time, which is important to the Air Force.

In 1943 we could build an entire bomber in about the same number of hours required for a B-52 electronic system. In addition to production, the same kind of error held true for the development work done on the electronic machinery in a modern weapons system.

When these figures are put on AMC's timetable for an upcoming

project, it becomes clear that the time phase of development is a major problem. While the subsystems are being developed to go in the B-52, it is possible for ARDC to supervise the development of at least three airplanes, or vehicles to carry the subsystems.

Working-level offices of AMC carry on their study a close concept of their mission. It is to give America the best possible air power at the least appropriate time and at a low and reasonable cost.

The mission is carried out through the Directorate of Procurement and Production. The duties of this staff, headed by Gen. Baker, are:

- To process material for USAF.
- To determine industrial capabilities.
- To insure that USAF industrial capabilities requirements can be fulfilled.
- To maintain equipment and to provide a program to expedite production on USAF contracts.
- To ensure surveillance over all USAF procurement activity.

ARDC's Role

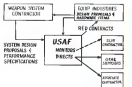
Prime responsibility over the weapons system during the design and development stages is vested in ARDC,

which starts the history of a new unit with an explanation of what its official call "the state of the art." At this point, ARDC, with headquarters in Baltimore, holds procurement authority independent of it by AMC.

Actually, it is when the USAF struggle for time playing begins. Starting with a general operational requirement (GORE) from a wing command, USAF, ARDC may ask up to a dozen contractors having expertise in the field to consider participating in a design study. If chosen, the firm will be paid for their work, plus a reasonable profit. The cost-plus incentive type of contract is used primarily because there is no way of predicting what the expenses will be.

Another advantage to the process is that ARDC, in consultation with AMC, by carefully playing the middle man, has an opportunity to spread the workload and encourage competing aircraft companies to keep their engineering teams on the job.

• **Design Study**—Out of a dozen units there, possibly eight companies will say they want to participate in the design study. At this point they know what kind of a weapons system is needed, the mission to be performed, the targets to be hit, the kind of



EQUIPMENT INDUSTRIES RELATIONSHIP TO USAF AND WEAPONS SYSTEM CONTRACTORS PRIOR TO CONTRACT:

Design proposals and subcontracts are evaluated by USAF for:

1. Sufficiency of technical approach
2. Determination of items to be Government furnished Aircraft Equipment
3. Development required
4. Where development should be accomplished

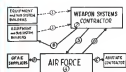
AFTER CONTRACT:

1. USAF ensures contractors to secure
2. Optimum use of process as standard components
3. Optimize duplication of "state of the art"



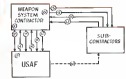
PROCEDURE FOR ITEMS SECURED BY ASSOCIATE CONTRACT METHOD

1. Weapons system contractors prepare a performance specification for the equipment as subcontracts
2. Weapons system contractors furnish it to the U.S. Air Force
3. USAF reviews the performance specification with weapons system contractors
4. Weapons system contractors prepare final performance specification
5. Weapons system contractors furnish it to the USAF
6. USAF reviews and evaluates bids, selects associate contractors
7. USAF establishes contract with associate contractor
8. Close liaison established between weapons system contractors and associate contractors
9. Engineering change proposals are furnished to USAF and weapons system contractors simultaneously
10. Government authorizes all changes to specifications made by associate contractors
11. Production specifications are prepared by associate contractor and approved by USAF



SELECTION OF CONTRACTUAL METHODS

1. Weapons system contractors presently will have secured generalized proposals for portions of weapons system from industry
2. Weapons system contractors prepare general design proposals for complete weapons system and furnish it to USAF
3. USAF examines proposal for technical adequacy and sufficiency of approach
 - a. Deficiency items to be Government furnished Aircraft Equipment
 - b. Deficiency items to be secured by subcontract
 - c. Deficiency items to be secured by associate contractor method



PROCEDURE FOR MAJOR NEW ITEMS SECURED BY SUBCONTRACT TO WEAPONS SYSTEM CONTRACTOR

- 1-2. Weapons system contractors prepare a performance specification for the equipment as subcontracts and furnish it to USAF
- 3-4. USAF approves the performance specification and issues it to the weapons system contractor
5. Weapons system contractor secures design proposals from potential subcontractors
- 6-7. Weapons system contractor selects best proposal and secures and fulfills proposal and recommended issues to USAF
8. USAF examines recommended proposal and secures in order to have approach and possible sources and approves proposal and source
9. Weapons system contractor negotiates subcontract
10. USAF monitors subcontract with
11. Changes which affect less, to, furnish in time will be approved by USAF
12. Final production specifications prepared by subcontractor and approved by weapons system contractor and USAF

usual approach that this is a period.

Thus reply must include a performance approach to the problem with complete cost information and other data which will be allowed to enter a weapons system is based on "flexibility" of the technical proposal the bidder's experience in the problem field, and the elements of cost is added.

Of right concerns major to help in the design study, ARDC may award contracts to him. When the studies come in the preparation rights to new contracts still belong to the contractor and he is encouraged to point them. The USAF retains full business rights and is free to incorporate any of the best into specifications for the weapons system. It is equally free to pass the better rights on to the chosen weapon system contractor even if it is not the same company that originated the idea in a design study.

Development Plan—Out of the design study, ARDC and its subsidiaries draw up a development plan for the weapons system, which is sent to USAF Headquarters and reviewed by the Air Council, composed of the chief of staff. When it comes back to ARDC with a final design, development work is started in cooperation with AMC to draw up a development contract.

Here is where the weapons system contractor enters the picture. Under the supervision of ARDC and AMC, he is made responsible for the engineering studies, design and development needed to integrate the software and major subcontracts, component development, support component and other items into a workable weapons system.

USAF is having both management and technical staff in a wide number of fields.

"To be an expert on a machine or plane," says AMC officials, "is no longer needed to be an engineer designer in development; a multi-tasking a computer contractor an address expert as electronics a pilot in the cockpit and a few more things besides."

"To add to the list what the best of would be on file in the Air Force."

Management Skill Need—AMC emphasizes that the management skills are important. It is necessary to have someone to handle the development of the weapons system. It is not easy to be a skilled work engineering and production expert.

It also demands information and is not an easy task and cost but as the design plans to solve the problems of maintenance and support awarded to the wing command.

USAF today has a program that is



difficult to suggest in the field. For all practical purposes, it must be pulled out of the software and sent to a technical office before a contract can be made.

The introduction of a new design, as needed in high-speed fighters to provide maximum strength and aerodynamic smoothness, has added greatly to the complexity of the design. In the interest of structural integrity and the flow of air over a wing it is not and expensive speeds, the need of inspection holes and covering plates continues to show plans has disappeared.

The manufacturer's ability to come up with the right answers to these problems is a continual and evaluated along with the more obvious factors, such as cost and the ability to fill completed weapons system out of the factory door.

Service Test Procurement—Once a contractor is selected, he immediately starts to demonstrate his management and technical skill in development of the weapons system in USAF's specific cases. This is followed by an initial pre-contract contract for a limited number of weapons system, from a dozen to 20-30, provide USAF with a model for an initial service test.

The service test quickly goes through the paper processing "loop" while an actual production is kept low. This is the so-called "Go/No-Go" plan designed to ensure that major developments will be made before final production starts.

The actual number of weapons system ordered in this period varies according to the lead time from the manufacturer's production shop, including other work under way in his plant.

"We want to build order down to the ground resources to permit a order" is the way AMC puts it. "In effect, we ask the contractor to tell us how big an order he must have to meet the production until we get into

trouble and want to start buying for us system."

Order purchases are based on the need to "buy."

Practical effect of this policy is to hold order down to a few orders per month through the first year.

Subcontractor's Role

While the weapons system contractor is given management responsibility for successful integration of all the software, component and support equipment, the weapons system design team heavily on subcontractors. The regulations provide for four sources of subcontracted parts, sub-systems and components.

Some sub-system components will be developed by, and produced directly from the weapons system contractor and his subcontractors.

This is called contractor furnished equipment (CFE). In addition to the software, it includes landing gear, hydraulic actuators, pumps and valves integral for sub-systems, engine equipment, external fuel tanks, external support equipment, electrical systems, flight control systems (in which) some electronic components and wiring are.

Some sub-systems will be developed by separate contractors, who will be USAF provide equipment, working to meet a specification prepared by the weapons system contractor.

Items that will be bought from separate contractors include major electrical power sources, major electronic systems, hydraulic, pneumatic systems, IATO units, constant speed drives, air frame and ground auxiliary systems for internal flight control, bombing, navigation, the control and weapon control systems and flight controls.

A third category of components will be furnished to the weapons system contractor as government furnished equipment (GFE). These items

Distribution of AMC contract backlog



AMC shows geographic distribution of AMC contractors and the regional delta volume of order backlog scheduled for delivery to USAF during the next 24-30 weeks.

are back to USAF specifications and brought directly by USAF. They include vehicle, vehicle, tank, tubes, engines (not for transport), instruments, radio and radio, night-vision equipment, safety belts, ordnance equipment and special weapons equipment.

A final category, the GFAP, will be produced directly by USAF to its own specifications and issued to USAF bases. The weapons system contractor never will use these items at his plant, but he must be sure nothing interferes with their ability when received and maintenance crews want to use them.

Included are such items as hardware and microphones, bomb fuses, cargo hold-down equipment, lights, fuse igniters, life rafts, survival kits, portable oxygen equipment, portable radio equipment, GCA units, ILS units, crash tracks, common tools, test equipment and personal equipment.

Associate Contractor

Among these categories, vehicles are immediately, will spot the associate contractor in a new model in the test schedule last November with the pre-approval of Air Force Regulation 70.9 like as there for a number of reasons:

- As an expert in his field with his own staff of engineering talent and production facilities, AMC may be able to help solve the economy and time phasing problems growing out of development and production of the items listed in this category.

- While he gets his specifications from the weapons system contractor, the associate contractor sells to AMC and operates under the technical super-

vision of AIRDC. This gives USAF, in approving the system, a chance to consider such things as ability to produce, location, subcontracting to military or civil, labor supply and other factors.

- The weapons system contractor in many cases is disabled by the use of the associate contractor and would be at a disadvantage in financial and business relations without USAF as an intermediary.

- Their activities in which the sub-systems or component manufacturers must engage but must be beyond the capabilities of a single weapons system. Unless he can place the item in several aircraft, his development and tooling costs will not be economically feasible to AMC and the American taxpayer.

- Because the weapons system contractor divides the specifications and has his preferences considered by AMC and AIRDC in the choice of the subcontractor, USAF expects their relationship will be smoother than that which exists in some cases between a prime contractor and a GFAP supplier.

- USAF's control over current procurement and facilities available as one of weapons manufacturers are improved by having AMC buy direct from the associate contractor. No weapons system contractors, having computer-processed equipment, can consider the long-range perspective for all of the Air Force as in some cases, even for a new system.

One of the weaknesses involved in the Korean buildup was the discovery that some prime contractors would order only the initial quantity of a component and the subcontractor was involved in delivering follow-on possibilities.

- There are cases where USAF will benefit by creating secondary sources of subcontracted systems or components. It can do this under the associate contractor system.

- For AMC, having been an associate contractor is now considered the province of CFE stress. The obvious reason is that from the viewpoint of Dayton's buyers, the weapons system contractor is a middleman.

- Introduction of the associate contractor last fall was hailed as a victory for the component manufacturers in their fight against the badly misnamed "single prime contractor" concept pushed at one time by AIRDC and approved by AMC.

- No Hank, Clark-Berg Gen. M. C. Denker, vice commander of USAF Air Development Center, has explained the microprocessor upgrading AIRDC policy.

"Many contractors," he says, "are distressed that USAF was going the weapons system contractor a back check, saying that the contractor was to do everything on his own, in his own facilities or facilities which he would create or control—all components equipment and sub-systems required for the weapons system."

"Nothing could be further from the truth."

Actually, the "true intent" may not be clear if the casual observer tries to find examples of the weapons system concept in operation. There are two good reasons for this. First is that the regulations permit AMC and AIRDC to divert from procurement problems if they agree that the good reason is that the contractor is needed to solve such factors as technical aspects of the problem, time schedules, the status of USAF developments and the capability of contractors under consideration.

The current weapons system procurement regulation, AFPR 70.9, is almost as simple as that, but there is no weapon system today being purchased on truly under its terms and policies. In the case of the F-105 or B-60 there are many CFE stress that would be applied by associate contractors if they were not so much an innovation. The B-55 is specifically exempt from its provisions.

Concededly, by their own nature most contractors a large share of CFE because of the technical integration problems that must be solved.

AMC officers say that the weapon system policy, under AFPR 70.9, will be applied in all possible purchasing in fiscal year 1971. And they are trying to move from CFE to the associate contractor method on current orders whenever it can be done without serious interference with efficiency.

Totals for AFPR 70.9—those too few development competition now under

way that will come entirely under the terms of 70.9 and give the suppliers the first final implementation. The regulations involve a jet engine, a utility belt, a cockpit, a long-range interceptor and a fighter bomber.

The first equipment contract placed with an associate contractor was awarded recently to the Echipe-Rousseau Division of Bendis Aviation Corp., for the design, development and production of a PB-20 autopilot system for the TC-33 turboprop transport. In five years, the associate contractor is working directly with Douglas Aircraft Corp., which provided the specifications. When the autopilot is in production, it will be bought by USAF and given to Douglas for inclusion in the aircraft.

Project Offices

Shielded with full responsibility for integration and production of the weapons system, the contractor cannot be expected to have the time, manpower and patience to control with the old USAF every person where his representative could intervene across of officers and not get an answer in a question.

To provide a focal point for his relations with USAF, in 1949 AIRDC and AMC created joint project offices for weapons systems. The JPO was a place where the contractor and every interested party to USAF, from the wing commander to headquarters could keep abreast of development and production. The proposal was rejected.

The tradition creating WSFO was its mission is "to manage the program" and "achieve proper planning of activities pertaining to development, procurement, production, maintenance, and supply in order that the weapon system can be delivered and supported in a timely manner."

WSFO is the place where critical decisions are made, balancing economic feasibility with technical excellence. For



PAPERWORK growth shown between original Wright contract and AMC B-67 work.

example, a proposal was made that the design of a bomb wing be changed to simplify construction and save 400 pounds of weight. The idea had merit; a cheaper and better wing could be built to the altered specifications. However, a study revealed that the change would be made at less in the production program than the cost of new tooling would be over twice the total economy possible in the remaining number of bombs. The proposal was rejected.

The tradition creating WSFO was its mission is "to manage the program" and "achieve proper planning of activities pertaining to development, procurement, production, maintenance, and supply in order that the weapon system can be delivered and supported in a timely manner."

Debrahn-Rosen's further delineates the roles of AIRDC and AMC by stating that "executive management

responsibility" be clearly established at all times. AIRDC is the executive agent during the development of a new weapons system, serving in this capacity at the start of a new project. Responsibility shifts to AMC when the weapon system goes into the production phase. USAF headquarters will issue a directive during the start time of the shift in executive responsibility.

Importance of this to the aircraft industry is that WSFO doesn't lose a base, to whom the weapons system contractor can direct his queries.

Regardless of the point in the life span of a weapons system and regardless of which command has executive responsibility, the status of WSFO remains clearly defined.

- It must schedule, initiate and administer programs for the development, testing and production of a weapons system and component.

- It must call on any USAF element with a vested interest in the weapon to provide necessary specialists when studies or recommendations are needed.

- It must keep close contact with industry and the single contract point for a weapons system contractor in his dealings with USAF on development and production.

- It must keep top officials fully posted on matters that may interfere with USAF's objectives. This involves status affecting the weapons system's ability to conduct, delivery schedules, logistic support, technical capabilities and the USAF/industry relationship.

The weapons system contractor is concerned closely with the third of these WSFO duties. The aircraft or component manufacturer will go to that office when he wants to do business in those fields.

Where AMC Contractors Are Paid

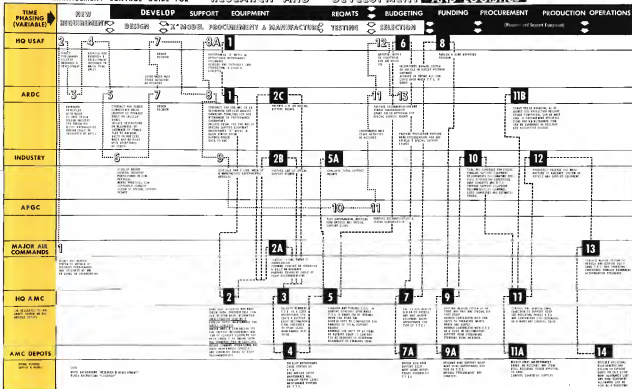
AMC FINANCE OFFICES

(Some areas include paying facilities)



1. "AMC Finance Office, Los Angeles
2. San Bernardino AFB, Motion AFB
3. Sacramento AFB, McClellan AFB
4. Santa Ana, Van AFB
5. San Antonio, AFB, Kelly AFB
6. "Guthrie City AFB, Tulsa AFB
7. Tappan AFB, Tappan, Kan.
8. Mather AFB, Memphis, Tenn.
9. Mather AFB, Memphis, Tenn.
10. "Wheeler AFB, Ohio, Wright AFB
11. "AMC Finance Office, Chicago
12. "AMC Finance Office, Dayton
13. "Wilkes AFB, Shreve, Ohio
14. "Bessemer AFB, Greenville, S.C.
15. "Madison AFB, Cincinnati AFB
16. "AMC Finance Office, New York, N.Y.

1 includes offices paying under procurement contract





BO CHICKING is duty chief at AMC

monthly meetings with WSFO.

Phasing Group

The phasing group includes representatives of manufacturers and supply as well as government in AMC, AFM, DC, Air Force, Air Training, Air Materiel, USMC headquarters, the prime depot and the technical commands it is a clearing house, where industry, such as equipment, by then ends in the table, when their papers and their signatures.

When chief of Major Gen. Clarence S. Jones, deputy commander of AMC is in command, the phasing group will select the number of weapons systems to be produced, the delivery schedule, testing rates and testing capability.

To negotiate contract terms and all the related paperwork, including purchase requests. The WSFO at this point determines what type of contract is most advantageous to USAF.

To obtain contract change notifications and review of engineering change proposals (ECNs). WSFO can authorize these changes if it believes the weapons system will be improved within reasonable cost limitations.

To negotiate supplemental agreements that may result from engineering and schedule changes.

To obtain information on CFAE schedules and changes.

To provide USAF with information on performance, maintenance and reliability that will be needed in the field.

Here the Specialists: The contractor must be sure that he will talk to USAF specialists when he goes to the WSFO.

From ARDC, he will meet project engineers assigned to analyze the system, subsystems and components such as engines, housing, navigation and fire control mechanisms.

From AMC, he will meet experts on production, production engineering and contracts. These groups are ready to set up CFAE schedules, take responsibility for testing rates and the deliverability of components. They will co-ordinate deliveries in the face of speeches or withdrawals and send out trouble-shooters when critical short stops threaten to upset the schedule line. They will evaluate engineering changes from the standpoint of how much they cost and how much good they will do.

While WSFO's duties include the submission of reports on matters that would interfere with a weapons system's ability, there is no direct connection with the command that will be the source. To overcome this limitation, another organization, called the Weapons System Phasing Group, holds

• Make sure accessibility and ease of maintenance are emphasized in design and production.

• Make sure you have designed and built into weapons system for all three cross-section, support and maintenance.

• Help keep USAF's spare inventory in line in terms of and speed up the procurement lead time, and the design.

The aircraft industry will study USAF's demands to give it greater responsibility under the weapons system concept only if the contract terms get a maximum number of orders with maximum incentives in mind and no limit.

Among veterans at Wright-Patterson AFB it is stressed that the well-known "cost-plus" per unit design is being brought back to the fore and material.

"They are not only two real reasons," says one civilian who has been on the job for a record 16 years. "One is the fact that the cost-plus design is the most widely used design for every possible defense benefit out of every pound of metal and man-hour of work. More efficient substitution of these things can be done through the weapons system concept."

AMC Contracts

Prime tool of AMC in affecting this kind of economy is the contract, of which the command has four reinforced forms.

Fixed Price

• **Single fixed price.** When feasible to use for supplies or services. These may be an outcome of competition, or in the absence of competition, the price is set by the price is low and reasonable may be possible.

• **Price I.** When possible to make accurate cost estimates for the first period but not for the remainder of the contract. They have been stock in the company pricing approach.

• **Price II.** When cost estimates can be made for the performance of the entire contract, but variations may be as low because of unpredictable changes in volume, material prices, wage rates or production techniques.

Retentive Pricing

• **Price III.** When accurate cost estimates cannot be made at the outset, but unit costs can be predicted after production experience is obtained.

• **Price IV.** When contracts are closely negotiated or negotiated in other areas, and the amount is \$100,000 or less. The unit price is expected to bear a reasonable relationship to the expected fixed price.

• **Price V.** When contracts are for planned advanced developmental items, or services for tests, and production

contracts with delivery schedules at short duration. The minimum price is expected to bear a reasonable relationship to the target price.

Cost Reasonable

• **Cost.** When likely to be less costly to the government, it is a contract to contract on any other basis.

Cost-Plus-Fixed-Fee Incentive

• **Fixed price.** When there have been predicted previously and sufficient production and cost experience is available to permit establishment of a realistic target price, and when there is a reasonable opportunity for contractor to reduce the cost.

• **Cost-plus-incentive fee.** When accurate cost estimates cannot be made at the outset, but when, with a reasonable production rate, incentive can be introduced. Cost-plus-incentive fee is the same as cost-plus-fixed fee except that the incentive feature is likely to move from profit to the cost-plus-incentive fee.

• **Price Reimbursement.** These add total amounts are paid out by AMC.

• **Price reimbursement or "cost-plus."** It is provided in each of these types of contracts except the first, the straight "fixed-price" deal, which holds for the vast majority of hardware of "off-the-shelf" items used by USAF.

• **The price in the history of a contract.** When the price is set at the outset, according to the type of work being performed in some cases it is predetermined, in others it is an optional price in the face of the contract.

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• The "cost-plus" is based on the contractor's experience and AMC policy is to maintain a healthy industry. There is no effort to drive prices down. The aim is to be a price that is fair and reasonable for both the manufacturer and USAF.

• **Other Guidelines.** Whether in the application, but followed in a guide to all contract negotiations, are a number of factors that a defense AMC contracting officer is thus approach.

One of them is the manufacturer's attitude and second in the field of research and development. A few AMC officers expect concern over the failure of some companies to protect their own interest by participating in design study proposals in taking other steps to develop new products. Development in progress, they say, is a factor considered in the determination of price.

How are some other factors that are important to USAF in deciding how much money a contractor should be prepared to make.

• **How much of the company's own money is invested in the plant, how dependent are they on government facilities and how much federal money is available.**

• **What is the backlog of government orders?**

• **How complex is the real item and how much technical and management know-how goes into the job?**

• **What the company's past previous work record, particularly in regard to delivery, quality, technical and managerial performance.**

• **How much risk is involved for the contractor in taking the contract?**

Company performance on these questions is the measure of its fitness to assume the responsibility AMC wants it to have, according to Gen. Baker, and AMC will show its confidence in a potential buy. One sign of the trend is an increase in the number of fixed-price and incentive fixed-price contracts.

• **How much risk is involved for the contractor in taking the contract?**

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These trends are not going to sufficient or complete producers. A company record should be taken with examples of high costs, technical trouble, poor management, questionable quality and delivery discrepancies and not being paid for work.

Gen. Baker lists some other things he is striving to do in the contract is duty, prove itself competent to meet USAF's needs.

• **To reduce backlog.** The backlog has been eliminated and AMC's procurement team is striving to use the contractor's information at every possible level.

• **To cut the time required for re-determination of prices and to move the time of re-determination up as early as possible in the contract.** A recent survey showed that a contractor is questioning only about 3% of the subcontract structure and has failed to correct more than 1% of those reviewed.

• **To cut down, eliminate as much as possible.** The number of letter contracts, or temporary deals, that delay final negotiations with contractors in an effort to give the industry firm commitment as early as possible, the number of contracts has been reduced by an all-time low, down 65% in the past year.

• **To reduce the number of reviews required of contracts between weapons system contractors and their subcontractors by CFAE items.** The current aim is to let contracting officers approve purchasing documents instead of taking the slow road of detailed examination into CFAE purchase items.

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MANUFACTURERS' REPS check in at weapons desk prior to making their bids.

TABULATION OF TEAM CAPTAIN RESPONSIBILITIES

AMC-ARDC Weapons System Project Office Responsibilities

UNDER ARDC TEAM CAPTAINCY

AMC

1. Furnish required personnel and logistical support to ARDC

2. a. Ensure that ARDC-directed responsibilities are suitably established.
b. Ensure that responsibilities provide for productivity and ease of maintenance wherever basic plans or changes therein.

3. a. Coordinate development schedules to ensure industry support capability and availability of government facilities.
b. Participate in joint determination of production readiness.

4. Organize scheduling, production, resources, proper environmental protection plan.

5. Prepare and defend all non ARDC funded requirements for government of ARDC approved configurations in approved schedules.

6. Perform all government and contractor functions except those specifically directed to be performed in ARDC by the contractor.

7. a. Coordinate with ARDC on test schedules.
b. Make maximum arrangements for contractor performance testing.

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ARDC

1. Establish

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AMC

AMC-ARDC Weapons System Project Office Responsibilities

UNDER AMC TEAM CAPTAINCY

ARDC

1. Primary responsibility—Team Captain

2. a. Ensure ARDC recommended configuration meets as it is production compatible and conforms to design intent with ARDC.
b. Coordinate all project configuration of production effort as schedules and costs. ARDC approved changes only.
c. Incorporate changes required for producibility and ease of maintenance into production with ARDC.

3. Establish and implement all production schedules, including cost and all supporting programs and services.

4. Establish budget plan and estimate all approved budgets.

5. Perform all government and contractor functions.

6. Coordinate with ARDC on test scheduling.

7. Make maximum arrangements for contractor performance testing.

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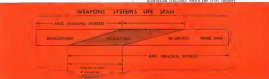
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AMC Planners Phase Weapon Systems

When AMC buys weapon systems it takes the first step toward the fulfillment of USAF's mission.

The mission is assigned, four years before the aircraft industry sets down to negotiate a contract, by the Joint Chiefs of Staff. They tell the Air Force, as well as the Army and Navy, what jobs must be done.

This delegation of responsibility is based on a Master War Plan, drawn up by the National Security Council and approved by the President as Commander in Chief of the Armed Forces.

USAF's present goal is to perform its mission in 137 ways. When it is reached, production rates will be used and the existing wings kept modern, unless the Joint Chiefs of Staff, on the basis of later information, redesign the mission.

Assuming that the 137-wing Air Force order stands, the industry's task will be to keep that Air Force modern, equipped with the latest technological advances for service in the first line of combat duty. Outmoded weapons will be retired to USAF's second line.

For example, the B-16 is our current long-range intercontinental bomber, a first line weapons system. By design, it will be replaced by the faster, high flying aircraft B-52. The Convair obsoles will become a second-line aircraft, possibly for use as an aerial tanker.

Programs and Analysis—Paper planning of weapons systems on an annual basis, so USAF will have what it needs to perform its mission this year and next and the years thereafter, has been the concern of AMCC's plans and programs office, headed by Col. M. S. Benedict. Under last month's reorganization, this group has been moved to the Programs and Analysis Office. The new chief is Col. Richard H. Utile.

It is from this office that the Deputy Director/Procurement must have a listing of weapons systems by category type before the aircraft industry can be approached to undertake design studies, the first step toward development of a new arm.

- Categories of systems are:
 - Bombers: heavy, medium and light, as well as bombing cruise
 - Fighters: day interceptors, all-weather interceptors, fighter-bombers, reconnaissance fighters and missiles
 - Transport: heavy, medium and light. The trend in heavy transports is to incorporate propulsions systems. Aerial tankers fall in the category
 - Helicopters: cargo and light
 - Tankers: The trend is toward jets, al-

though USAF also is buying the prop-driven Ranch Hand.

• Missiles: Inter- is this category fall interceptors, sea and air-to-air craft and airborne early warning (AEW) aircraft.

The number of weapons systems needed in each category is determined annually at USAF headquarters. AMCC reduces the schedule to a TMS (type, model, arm) listing, a job that is done in cooperation with the Air Research and Development Command. Together, they are seeking basic Air Force guidelines—the best possible weapons to fill the requirements at the lowest possible cost.

• **Background for Decision-Making**—In order to make a decision on a system:

- Evaluation feasibility
- Time phasing of equipment with the latest technological improvements in such fields as radar, communications, fire control, engines, bombing systems, photography, instruments, propellers and AI related responses
- Evaluation of contractor's proposals.

From the data and ARDC's advice on technical matters, AMCC then draws up a weapons system schedule and submits it to USAF for evaluation. The schedule answers two vital questions:

- When will USAF get the needed?
- How much will they cost?

In more detail, the schedule also lists sizes, type, model, quantity, the contractor's facilities and time phasing.

Before going to USAF headquarters, the schedule is screened by AMCC's chief, Gen. Edwin W. Ransburg, and his staff, including the vice-presidents, his deputy for production, directors of procurement and production, supply

and services, maintenance engineering, personnel and support, procurement and the comptroller. In addition, the schedule, plus a separate quality control and other of information services may be called upon to join in the review.

USAF headquarters next must determine whether the proposed procurement schedule provides the best possible answer to the mission requirements.

Evaluation is made by the Weapons Board, the Air Command-in-Chief of the deputy chiefs of staff and the Secretary of the Air Force. The best weapons systems for the outcome—Strategic Air Command, Tactical Air Command, Air Defense Command or Training Command—must come out of this study.

• **Final Review**—Once these recommendations are made, the program moves up to the Secretary of Defense and the Bureau of the Budget, which represents the White House. It is finalized and frozen, mostly by the Christmas season, and makes its first appearance as a requirement when the President discusses the State of the Union and the budget in his January messages to Congress.

Comprehensive review of the program, with hearings by Senate and House committees, comes in the spring. Here USAF defends its weapons systems proposals. Changes made necessary by budget cuts are incorporated.

By July 1, AMCC has its procurement decisions from USAF and the contractors are called in. At the Programs and Analysis Office, the next cycle starts in order to buy. ■■■



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Reshuffle Clears Procurement Channels

An internal reorganization was put in effect last month in the Directorate of Procurement and Production, headed by Maj. Gen. David H. Baker.

The changes will benefit the weapons division contractors by isolating his posts at contact with the Air Materiel Command and permitting him to confer with offices holding authority and responsibility.

Actually, Gen. Baker was the trigger action mainly as an effort to improve his internal management and cope with the global nature of AMCC's procurement problems.

► **Clear Channels**—The general describes the new setup as similar to that of a large industrial concern. It clarifies former branches to division status and creates three deputy directorates. The division heads will report directly to Gen. Baker, not by way of an intermediate.

Under the old table of organization, branches concerned with such items as field procurement, contracts, man-distribution, industrial resources, etc., were opened under one of three divisions—Field Operations, Procurement or Production and Resources.

New Directorates

It was felt that staff and operating functions were not properly separated, responsibility was divided and that it was impossible to delegate as freely below the division level.

On the new organization, Gen. Baker said, "I will have a Deputy for Procurement, a Deputy for Production and a Deputy for Mobilization Planning. These functions will be similar to those of vice presidents charged with corresponding responsibilities in industry."

"This reorganization has become necessary in the light of the new responsibilities with which the Direc-

torate has been charged since 1946. These include demobilization of a large percentage of procurements and a vast, increased span in operations in defense procurement and production."

► **Responsibilities**—Goal—Total of the reorganization plan is to achieve these improvements:

- Separate staff and operating functions to support, control, its responsibilities and allow maximum delegation of its authority.
- Give the contractor one point of contact for business and procurement and one point for business connected with production.
- Provide increased emphasis on the utilization of world-wide procurement activities.

► **Deputy Directorates**—The three new deputy directorates are:

- **Brig. Gen. William T. Thurmond**, Deputy Director, Procurement, will assume staff responsibilities over all USAF procurement. This includes foreign buying, field procurement, local purchases in, other commands and major procurement by ARDC.

Gen. Thurmond will direct purchasing at the Air Materiel Area, Air Force and local purchase activities, in addition to any buying functions assigned to divisions of Gen. Baker's directorate.

► **Brig. Gen. Clyde H. Mitchell**, Deputy Director, Production, is in charge of production functions all over the world, including AMCC field activities and the various commands. He is vested with authority over such manufacturing as weapons in machine tools, facilities, raw power and materials needed for current production.

It will be Gen. Mitchell's job to solve major production problems and assign responsibilities in components, configuration, engineering changes and delivery schedules. He will also be responsible for the facility capability report system.

► **Col. Vincent T. Cannon**, Deputy Director, Mobilization Planning, will fill a post putting new emphasis on the importance of planning by the aircraft industry. Formerly located at bench level in the old Production and Resources Division of the Directorate, these responsibilities now will be at staff level.

Col. Cannon will create, evaluate and disseminate mobilization require-

ment schedules in preparation for M Day.

He will develop and recommend policies and procedures that should be included in procurement plans.

"The industry can expect more intense activity from Gen. Cannon's office in the general field of industrial mobilization plans. He will set up a program to assess expenditures and improve the productivity of what comes out of the assembly lines."

New Divisions

The six new divisions that were created in the reorganization of the Procurement and Production Directorate will be directly responsible to Gen. Baker. When they work on procurement, production or mobilization they will report to the divisions responsible for these activities. The divisions:

- **Aircraft**, formerly a branch in the procurement division.

- **Armament, Equipment**, will take over the functions of the old Armament and Equipment and Electronic Branches of the procurement division.

- **Aviation, Maintenance and Service Contracts**, formerly a branch in the Procurement Division.

- **Readjustment**, formerly a branch of the Field Operations Division operating.

- **Support**, will take over the functions of the old Production Support Office and the Procurement Support Branch.

- **Industrial Resources**, formerly the Production Resources Division.

Research and development procurements formerly assigned to the R&D branch now will be handled by these buying divisions which deal with the specific commodity. ■ ■ ■



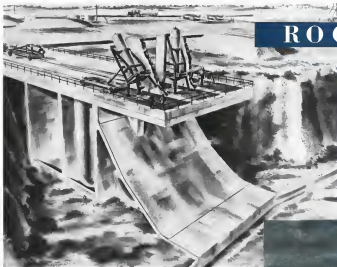
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PROUREMENT COMMITTEE MEETS From left, F. L. Sklaris and J. R. Fox (both on leave with committee), R. W. Bucklett, J. H. Fort, L. A. Mason, Charles E. W. Rens, and F. W. Byrdine. Committee members L. R. McGee and G. R. Ridge are not shown.

'Court' Double-Checks AMC Contracts

An Material Command's "court of review" for contracts in the Procurement Committee, a seven-man group of civilian specialists in the major fields of procurement.

The committee, which operates as a staff office of the Director of Procurement and Production, is loosely responsible for:

- Objective examination of all aspects of purchasing and contracting documents that exceed \$100,000. Committee may, at its discretion, examine any contract, regardless of kind or amount.
- Review and recommendation of new procurement policies.

Procurement Committee was formed in January 1946, shortly when the Air Force became a separate service. Formerly the procurement procedure required that all large contracts be forwarded to the Secretary of War for approval.

Faster Handling

Industry complained about the length of time required for procuring contracts, and the Air Force delegated the authority to the Commanding General at AMC. Formation of the Procurement Committee followed quickly to ensure faster handling of more contracts, some value of the War Department.

Is the Deal Sound?—Procurement Committee has one cardinal, overriding question to answer in its analysis of a contract. Is it a sound business deal for the Air Force?

The main elements of the contract are focused in detail. They are:

- Pricing.
- Type of contract.
- Technical features.

Russell Burns, chairman of the committee and a member since its formation, explains the committee's work.

"We must look at a contract in its entirety. It's a matter of balance. In some cases the price may be fulsome

from one viewpoint but other factors may produce good results for the price. We believe in paying a manufacturer what he earns.

You cannot use a rigid system of reimbursing profits. There are elements involved in doing the job such as the amount of government financial assistance, the complexity of the item, the efficiency of the operation and the nature and degree of subcontracting," Burns says.

Two-Man Review—Every contract referred to the committee is reviewed by at least two members who meet once or if they fail to agree a third member, usually the chairman, is brought into the discussion. If the dispute is not resolved among the three members, and it involves a major policy, a full report on both sides of the controversy is furnished to Maj. Gen. David H. Baker, Director of Procurement and Production, who makes the final decision.

Contracts referred to the committee first go through a checking phase to assure that such contract papers as a facility capability report are contained in the contract folder, and that the requirements of the contract are correctly stated.

There is no special point of releasing contracts to manufacturers for review. They are assigned to committee members on a rotating basis. All members, of course, are available for informal contributions on points involving their specialties.

The committee reviews contracts that account for approximately 75% of the funds expended by Air Material Command. During Fiscal 1955, the committee processed 5,816 documents of which 2,372 were formal contracts.

Members can approve deviations in standard contract provisions with the exception of those that do not conform with Armed Services Procurement Regulations, supreme guidance factor in procurement for all three services. Can contract deviations from the ASPR, if con-

ceded in by the committee, are sent to USAF headquarters where the Air Force branches back with the Navy and Army.

Policy Decisions—The committee is also a source of procurement policy.

Recent committee report completed by former member Lloyd R. Fox, who has been named chief of the purchase surveillance section, was the consolidation of the 1,154 separate regulations dealing with Air Force buying. He consolidated the regulations and instructions—United States Air Force Letters, Air Force Regulations, AMC Regulations and Letters and other guidelines and orders that make a formidable task, involving 14 H. Many of the regulations were duplicated, others covered dated previous instructions. Fox layed his consolidation to the ASPR numbering system. He suggested to compare all the procurement rules into a fully revised 1,100 pages.

Committee must make two important checks in advanced purchases:

- Does the advertisement describe accurately the requirements?
- Does the manufacturer's bid conform to the requirements?

Committee Personnel

The committee brings a broad total of experience to bear on a contract.

The organization, in addition to Burns, who is a pricing expert, includes two lawyers, an aeronautical engineer, another pricing expert, a school and training expert, and a professional diplomat who once served as Australia's ambassador large to South America.

Members of the committee and their backgrounds:

• Russell Burns, committee chairman, is a native of North Dakota. He attended high school in Dakota, Minn., then was graduated from Hamilton University, St. Paul, Minn., the same school that Gen. Banfill attended. He acquired an economics at Stanford and later acquired an accountancy degree

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■ PROCUREMENT

from LaSalle Extension University.
He has worked as a Duluth bank teller, manager of the collection department and team credit manager of the Minneapolis branch of the Universal Credit Co., later joining Investment Specialists as assistant of the company.

He entered federal service in 1942 with the Air Technical Service Command, predecessor of the Air Material Command. There, expressed and directed the first Force Analysis Group for artillery, rockets and propellers. He remained in that position until 1948 when he was tapped for membership in the Procurement Committee.

Berry, who has gained a reputation as ABC's "scar-craving reformer" in the procurement field, says that "price analysis is an art, involving many factors."

"In analyzing a price," he says, "it is necessary to review all elements of the price and usually take a long look ahead and attempt to figure trends in material costs and labor rates. Current contracts run as long as four years."

"In relatively simple contracts it is still necessary to understand factors that make up a price. If we are taking for a short delivery time on a large quantity, that fact could affect the price once the manufacturer might be forced to subcontract parts of the job. If we are asking for substantially larger quantities than in previous orders, we should determine if the company might have to set up new lines and personnel. All of these factors must be considered in determining a reasonable price that is low to the Air Force and the manufacturer," Berry says.

Ernest W. Buckett, a 51-year-old lawyer from Mahwah, N. Y., has a solid background of law and government. He is a graduate of Cornell University and has been admitted to practice before the U. S. Supreme Court. He practiced law with a Utica, N. Y., firm and served as president of the New Jersey Club.

Buckett entered the Army in 1942 when he was called up as a reserve officer. He was assigned as a contracting officer at Middletown Air Depot and Rome Air Depot. In 1945 he was transferred to Wright-Patterson AFB as chief of the local purchase section.

Following Buckett's discharge in 1946, he became civilian chief of contracts branch at Air Force headquarters. He served on the ASPR committee and transferred to the Procurement Committee in 1950. He recently redefined 26 standard Air Force contract forms.

Lloyd A. Massey, 52, is a lawyer on the committee and, along with chairman Berry, a member of the original committee.

He is a native of Kansas, a graduate

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of the University of Kansas and Harvard Law School. He practiced law in Chicago until 1943, when he entered military service and was assigned to Wright Patterson. He has been there ever since.

MacGorge served as a contract writer in the procurement division during World War II, and was chief of the legal branch for two years before joining the committee in 1948.

He is responsible for setting up and conducting a school for buyers and advising the first handbook on local purchasing procedure and policies.

• **Frederick W. Strouten, 51**, joined the committee in February 1951 after 18 years of civil service duty with the Veterans Administration in Cincinnati. He specialized in handling school contracts with the VA and is the committee's expert on training contracts.

• **C. Reid Hedge, 34**, is the youngest and most recent member of the committee. His specialty is purchasing procedure and price studies. He studied industrial engineering at the University of Illinois and, after working briefly in private industry, entered government service in 1942 with the Army Signal Corps at Wright Patterson. He is engineer in the sales laboratory. He later studied electrical engineering at the University of Michigan.

Hedge became a buyer with AMC in the procurement section in 1948 and three years later was named chief of the procurement office of the electronics branch. He had worked closely with the committee before being named a regular member of the staff. Hedge assisted in the preparation of the first training officers' handbook.

• **Levin H. MacGorge** brings the diplomatic touch to hard-headed bargaining over contract terms. MacGorge, now retired from Australia's foreign service, was born in Scotland. He is a law grad of Glasgow University and later acquired a degree as secretary in Australia.

MacGorge joined the Australian government service during World War I, transferred to the foreign service in 1919. He served 31 years in various diplomatic assignments, mainly in the field of embassies. He headed the mission for the Australian government in Europe, Canada, Asia, Africa, and South America. He negotiated the first trade treaty between Australia and Canada in 1930.

During World War II MacGorge was Director General of the Australian War Supplies Mission in the U. S. and Canada. He met Gen. Eisenhower while assigned to that assignment. After returning, MacGorge decided to live in the U. S. in order to be with his child.

Gen. Banaghis heard about MacGorge's presence in the U. S. and

asked him to join the AMC staff on a temporary basis. "I decided to take the job for three months," MacGorge says, "and I've been there ever since."

MacGorge is available for special assignments by Gen. Baker. MacGorge recently acquired U. S. citizenship. He is presently assigned at AMC on a contract basis. His background in law, secretarial and diplomacy has been a great help. MacGorge says, "There is not a great deal of difference between a diplomatic agreement and a commercial contract. The principle is the same, two parties seeking to reach a meeting of minds."

"I look at a contract by these lights," MacGorge says, "Is this a deal that will get signed into law? Does it have political implications? How will it affect the community? Is it in the best interests of the government?"

• **Joseph H. Frost, 38**, is a West Point graduate, a pilot and the engineering professor on the committee. He has a master's degree in engineering and is a consultant from Stanford University and attended the aeronautical engineering school at Wright Patterson.

During World War II, Frost set up a B-17 mechanic training school and organized the first mobile unit for mechanics. He spent practically all the development of "crate control" techniques that assisted bomber crews.

Frost was then assigned as operations officer for the first B-29 wing, and later became director of training for the 38th Bomber Command. He accompanied the command to the China-Burma-India Theater where the unit arrived in northwest China for its duties directed against the Japanese home islands.

He was then assigned to Wright-Patterson AFB where he was responsible of aircraft design. After a second overseas tour in the Pacific, Frost returned to the U. S. and was assigned to an advisory duties on the West Coast. He resumed his position in 1951 and joined AMC as a buyer. He became a member of the Procurement Committee in October 1952.

His engineering knowledge is a strong factor in following decisions that involve the purchase of technical equipment.

Example: Frost's knowledge of the complexity of counter-ship devices, which are used to regulate the speed of generating equipment, was the deciding factor in approval of a high-voltage source for the item. Frost pointed out to the committee that lower voltage had not demonstrated their ability to produce the equipment and the need was urgent enough to require approval of a probe, through some experimental source. ■ ■ ■



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the other," the colonel advised. A few days later the lieutenant was back again. "Colonel, I've just been offered \$1,000 to those that contract," he said. "What should I do now?" The colonel's reply came back "Turn it down."

Two weeks later the lieutenant again appeared before the colonel, once again before. "Colonel," he cried, "I've just been offered \$25,000 as that contract deal. What about it now?" The colonel's answer, a little more reluctant, was still "Turn it down."

"I know, I know," the lieutenant said, "but they're getting awfully close to my price."

► **Meyers Case**—The Office of Inspection was formed in August 1935 when Gen. Edwin W. Renshaw resigned concerned of AMOC. It was specifically created at preventing a recurrence of the "Meyers" case, a charge in grossly negligent. The office was placed in the Procurement and Production Directorate because it handles all purchasing for the Air Force. Col. Robinson says:

"Where money and people are together there will always be opportunities for fraud." Evaluation and Procurement has plenty of both. 10,645 military and civilian employees who during fiscal 1936 were responsible for the obligations of about \$2.5 billion.

In addition there are many others who keep by petty cash in sums totaling into millions of dollars.

Approximately 95% of the fraud cases involve procurement. Most of the information leading to investigation came from tips supplied by employees.

"AMOC employees live in a gilded bowl," says Col. Robinson. "For instance, if a buyer accepted an invitation to a golf game from a manufacturer's representative and they are seen to prefer, an immediate response may develop concerning their relationship. That suspicion must be avoided."

"In our defense on possible schemes, we let the purchaser be the victim," he says. "Someone in AMOC buys a car, a seller in his hotel room and they leave a social evening together. If this incident is reported to us and proven by investigation, we would consider the individual's past record before recommending action. It might consist of just a 'checking out'."

► **Disgraced Purchase**—Maj. Gen. Philip W. Smith, AMOC's controller, put the publicly granted a sharp perspective in a recent speech before the National Association of Purchasing Agents.

"I think we all realize that there are no instant fix who are enemies or unopposed," Gen. Smith said. "They are responsible for the growth

	
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Ketay leadership is the result of a combination of research, experience, and outstanding manufacturing facilities. Some of these facilities are pictured here.

Ketay has produced many items in automatic controls. For example, in Synthesizers, Ketay was first to produce miniature Synthesizers as reliable for their high accuracy and extended reliability. Ketay was first to produce high temperature and vacuum vacuum Synthesizers.

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Inspection of all parts sub-assemblies, as well as completed instruments, is a habit at Ketay. For instance, all bearings are inspected with specially designed equipment in air conditioned work space. This is just one of the many techniques that ensure maximum performance when Ketay units are specified.



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Projects pictured here are recently completed examples of International hangar door installations at aircraft production plants throughout the country. In each case the doors were designed by International engineers to meet specific, unusual circumstances.

ABOVE: Telescopic Hangar Doors on BOEING 747 FLIGHT HANGAR, Seattle. Which—undoubtedly constructed and checked by INTERNATIONAL—world's longest class of its type for this world's most powerful bombers.

RIGHT: INTERNATIONAL PORT IN TALLANCE at BOEING 747 FLIGHT HANGAR, Wichita, Kansas—world's largest opening class of \$5,000 square feet—world's largest entrance.

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LEFT: INTERNATIONAL 36,000-TON DOOR at LOCKHEED 34-000 FLIGHT HANGAR, Marietta, Georgia—affording a total entrance width of 1,250 feet.

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■ PROCUREMENT

of patterns which, if applied solely to purchasing for commercial production would regularly place themselves out of the scene. Undoubtedly the concept was of some of the unusual lines of competition, inevitable in our vast and rapid technological expansion during the last few years, which circumstances under which they can develop if not checked.

"There are also cases which can keep the usual perspective of a few weeks or months. The billion dollar negotiation of emergency military procurement needs, without the obvious political restraints of our staff. We live with us the old, massive custom of the lock-box, which can put the heart out of any budget, no matter how big. We have the sharp doors, which the man-the edge of base loyalty and the customer from here looking to horizontal. And we have the man who at a shabby price upon their responsibility to their country.

"It is interesting to realize that a man who would dispute the position who give such a supply of tactical food and carbide steel to the Civil War troops can still maintain themselves in a way related to our present situation. He looks himself to the fact that every time he takes from our resources work out at that week in use stand against the position that our nation has ever faced," Gen. Sauer said.

How NAMR Feels

The Natural Attention of Man for his own government is behind the military regulations are too exact. The NAMR was organized in 1955 as to exchange information on new government procurement policies. The organization has a membership of about 500, most of them based in Dayton and during sessions with AMG NAMR holds monthly meetings where they hear top government procurement officials clarify procurement problems, increasing changes and budget figures. Bayler View-Picker Boyer, president of NAMR, represents five firms in Dayton: Acroma Manufacturing Corp., Seating Products Corp., Smith, Perdue Co., Inc., Detroit Hercules Co. and Grand Central Aircraft Co. He is a former Air Force officer and once served as base commander at Wright Patterson AFB.

Boyer says "I believe the military policy has been carried too far. It used to be that we could call a man at AMC and have lunch with him in the suburbs and discuss business. It served time for us and the government."

"I have never in my experience heard of anyone giving a contract to someone just because he had lunch with him. I am certainly against pay-offs in get

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M PROCUREMENT

ing contracts, and I would do anything in my power to see that a new jointing project would be properly dealt with.

"The new policy has reached such an extent that I can't visit the homes of an AMIC employee and be can't visit mine. We can't play golf together or enjoy a casual friendly relationship. For instance, the guidelines forbidding by legislation cover such ordinary personal items as pencils, calendars, blotter and even matchbooks.

"One of the representatives here had a subsidiary company that sold lighter fluid. The customer carried the name of his company and he thought it was a good idea to put a few words for advertising purposes. The area agent here wrote him at least three notes but they put a stop to handing out the can of lighter fluid.

"Self-Policing—"We try to police our own impression. If a man doesn't conduct himself in an ethical manner we will discipline him by expelling or terminating his membership. We also serve as a focal point for complaints the Committee may have regarding the conduct of member's representatives. These complaints are considered at our meetings and we take action on them.

"Col. Robinson does a most efficient job in his inspection efforts. All he can do is follow the policies laid down by the Air Force. But they are much too strict and differ greatly from normal business practices between private firms."

How Ol Operates

The Office of Inspection during 1957 handled 1,500 cases involving fraud, misappropriation, requests and kickbacks. The cases are about equally divided among the three categories.

"Fixed Cases Up—The number of fixed cases during 1954 probably will exceed those recorded in 1953 since many of the cases involve contracts that were let during the Korean emergency and are just coming to light.

"The odd thing about acceptance of gratuities," says Col. Robinson, "is that most of them do not have a pecuniary or a significant value. These include such things as free vacations, lunch entertainment or some item like a \$15 cigarette lighter."

Col. Robinson is cautious about the ethics taken against contractors suspected of offering gratuities. "We take the necessary action to protect the best interests of the government," he says. "Presumably the owner that the contractors are placed on a list marked 'Look Out.'"

A large part of Robinson's present time is taken up in dealing with the ethical bodies. "These are buyers who



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More horsepower than ever before has been packed into extremely small dimensions—like the four-inch diameter frame which delivers 3 hp and weighs under 10½ lbs. In spite of this small size and high rpm, temperature rise is kept exceptionally low by using new cooling techniques giving optimum thermal characteristics to produce the greatest possible horsepower per pound at all altitudes.

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There's a new headquarters for the Westinghouse Aviation Gas Turbine Division . . . at the rapidly expanding Kansas City plant of the Corporation. This headquarters room gives Westinghouse capability to serve the aviation industry and national defense.

First used as a production facility to meet increased demands for Westinghouse engines, this modern plant now houses all aviation gas turbine activities. Contributing expansion of research and development facilities makes it a completely integrated jet engine research, development and production center . . . the largest and most completely equipped in the world, and all under one roof.

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Westinghouse turbojets are rolling off the production line at Kansas City. Manufacturing facilities include an 80-acre plant, production under a quarter-mile long, multiple processing line and integrated flow system—all devoted toward mass production of jet engines. It is a completely self-contained factory, equipped for precision work.

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This new Collins facility in Cedar Rapids is representative of Collins and Raytheon laboratories for the development of specialized equipment.

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REGULAR AIRLIFT of expensive jet engines such as these Pratt & Whitney J75 cuts pipeline loss, reduces procurement costs.

■ **LOGISTICS**

Logistics: Keeping the Pipelines Full

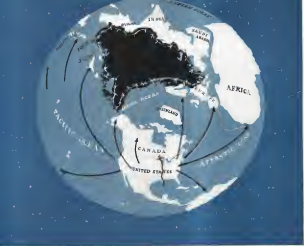
Increasing efficiency of its global supply system is a critical task facing Air Materiel Command. In tackling this job, AMC is working against three strong trends:

- **Rising Force Level.** As USAF builds to 137 wings, AMC has to expand its supply system to meet the needs of a substantially larger Air Force.
- **Global Deployment.** USAF has combat units deployed in Europe, Africa, Asia, and the Arctic. Longer supply lines require either more items to

keep them filled or faster delivery methods.

- **Increasing Complexity.** USAF now requires AMC to handle 134 million different types of items. New items, mostly avionics, are coming into the supply system at the rate of 300 a day.

Because USAF now requires large portions of its combat strength to be maintained in a state of instant combat readiness, AMC must provide logistical support at 100% level. Combat-ready forces must have everything they need all the time.



GLOBAL PIPELINES at AMC's forward supply system require air transport for high-cost equipment to keep combat units combat ready.

Airlift Helps AMC Cut Logistics Knots

Air Materiel Command is looking toward increased use of airlift to help solve two knotty USAF logistical problems.

AMC believes that airlift helped to meet specific logistical problems and expedited with the best management and traffic control procedures of commercial airlines can do these things:

- It can maintain a higher percentage of USAF combat aircraft in a state of service combat readiness by speeding north delivery of vital parts required to keep fighting combat units in prime operating condition.

- It can effect more economy in the quantities required of high-cost USAF equipment items, such as jet engines, radio landing systems, propellers, electronic gear, etc., by directly cutting supply pipeline times and the number of such items necessary to keep a global force full.

- New Status-USAF gave airlift a new status in its supply pipeline system last

April with the publication of Air Force Regulation 70-16, which recognizes air transportation as a normal rather than emergency method of transportation. It also establishes policy guidelines concerning USAF to increase practical use of air transport for regular shipments when economically sound instead of only for emergency.

See AFR 70-16 "Whenever the established combined cost of transportation, packaging, handling, and damage by air shipment is less than the estimated cost by other means, air transportation will be used to the extent available."

"In AMC," says a logistics expert,

"we are interpreting this policy to mean that the use of surface transportation for bulkhead, arrival in occupancy-regulated items must be justified in each case. This is a reversal of the past policy that required full justification for the use of airlift."

Logistics Planning Section-USAF and AMC have been experimenting with airlift applied to specific logistical problems and studying broad development of an aerial logistics system on a semi-regular basis during the past two years.

In USAF headquarters, a special logistics planning section monitors this problem. Serving as special consultant to USAF Secretary Harold Tibbitt and the AMC on airlift problems is J. J. O'Donnell, formerly a vice president of Capital Airlines and a veteran of 27 years as an transportation

Among the conclusions reached in a study of these experiments and studies:

- Substantial savings can be made through the use of commerce and effective airlift by reducing pipeline time and the resultant costs in procurement requirements for highest equipment.
- Enlarged airlift capacity would assist the D-38 capabilities of USAF.
- AMC must have the security of a wartime airlift capability in being for long periods. First step in this direction was establishment of the "New Day" Service, linking all major AMC bases in the United States with five C-54 roundtrip routes.

As a result of these conclusions, AMC air transport experts say, "We are continuing our efforts to establish solid point-to-point requirements for the use of airlift within the USAF logistics system."

Since AMC's traditional concept of aerial logistics has been to use USAF-owned aircraft operated and maintained by replaceable air crews on a competitive-bid basis with high-grade dual pilots, it would appear that both scheduled and unscheduled airlift services will be extremely convenient to the greatest forward rear and permit aerial airlift requirements.

Spotlight on Engines-AMC has focused its most extensive experiments and planning on airlift of engine on ground, both piston and jet. Engines are perhaps the most critical items in the USAF supply system. "This is why:

- They are getting to be increasingly expensive. A Pratt & Whitney T77 has listed costs \$210,000—about the same cost as a World War II P-51 fighter. USAF budget cannot afford stockpiling such expensive items in large quantities.
- They are both a precision and one-hand item. Lack of such delivery of engines to airframe plants slows deliveries of complete weapons systems to USAF combat units. Lack of such movement between USAF combat units and AMC forward depots keeps too many engines out of service and too many smooth out of commission. Under current surface pipelines, one type of jet engine incurs four weeks in service, and seven months in transit and in the shop for each overhaul cycle.
- They are subject to a relatively high risk of destruction. If USAF had to buy quantities of new engines large enough to fill a surface pipeline (average 300-400 engines between U. S. and Korea), it would be stuck with huge quantities of unused equipment when security was needed very rarely.

Becha Experience-AMC got its first substantial experience with an aerial pipeline the engines during the Becha airlift when the 34A15 squadron of Douglas C-74s shifted large loads of 20 W/WA R1800 piston engines each

between the big G-56 mainbase airport at Buckenham, England, and the AMC forward depot at San Antonio. Without this swift shuttle of engines the C-54 fleet supplying Becha would have collapsed.

After the Korean war began, AMC started an experimental in-service aerial pipeline with combat-ready C-46s between the San Antonio forward depot and the overseas forward point for Korea at Sacramento, AMA land station. The conclusion, AMC and USAF will make separate cost studies of this project. Cost averaged 33 cents a ton mile.

Other experiments were conducted, shipping W/WA R1800 piston engines from the manufacturing plant at Buena Vista, plant in Canada's B-75 assembly base in Ft. Worth. Stock Airways used its own DC-6As for the service, and later Airway Import and Export Co. took over with C-119s.

Project Shovel-In the fall of 1952, Project Shovel was initiated as a true airlift logistics experiment in moving R-4500s from BWFA and ANSC

aports to Strategic Air Command B-50 ships in the field. When runs in overland routes were delivered in the B-50 wings, old engines ready for repair were caused to the overseas depots or BWFA base on the pipeline.

- The result of Project Shovel convinced USAF and AMC that use of an aerial pipeline for engines would:
- Cut pipeline times by one third.
- Substantially cut purchase of engines to support any particular strength program.
- Cut transportation costs to using lightweight inexpensive shipping cans (about 12% of engine weight) instead of the expensive and heavy steel ones.
- Prevent better management, control over high-cost items and allow tighter scheduling of aircraft by ensuring no gaps requiring stops to depots on the loadout from delivering noncombat engines to combat units.
- Streamline engine losses incurred from Shovel runs.
- Controlled traffic movement and partial control in accidents. With these methods it is possible to average close to



EFFICIENTLY MANAGED airlift of expensive engines to combat units means



REDUCTION in quantity of jets to fill surface transport pipelines



GIANT CONVAIR XC-119, largest transport now in service has powered operational techniques for \$50,000 to payloads over long range.



FAIRCHILD C-119 receives large cargo with ease, loaded from truck bed level.



DOUGLAS C-124 supplies Arctic outposts that are isolated from surface pipeline

LOGISTICS

100% payload and costs of 33 cents a ton-mile for each operation.

• Considerable investment in transport assets, weight cargo handling equipment and ground handling equipment is necessary to cut pipeline time further.

As a result of Project Skyway, AMC is now seeking an air transportability study of all its high cost items.

"To make aerial logistics really pay," says an AMC air transport expert, "they must be operated under tight, efficient airbase-type traffic movement. It's no good just to get stuff per se. High-cost airlift could soon consume all pipeline savings. You must have all the other techniques that go with it. You must identify the surface pipeline for each specific high-cost item and then chop away at it with airlift."

For example, airlift is most economical when it provides door-to-door service between source and consumer. If you have to package a shipment for military movement to the nearest air port, all of the economy from pipelines is lost, air-transportable packaging is lost.

"Although there are special logistic carrier assets under development for USARV, we don't have to wait for them to get an effective aerial logistics system. We can make an excellent beginning with the C-54 and C-46 aircraft that we already have available."

• Mercury Service-AMC took the first step in establishing a domestic aerial logistics system recently with the Mercury Service operated by two non-armed civil carriers with C-46s under a three-month contract.

AMC established the Mercury Service as an answer to the high cost of air transport for special cargo. An AMC survey indicated the combined spent \$150,000 monthly for conventional air-lifted, air deliveries and air express.

As AMC air transport study estab-



Not an odd, rain or shine, the Hobart POWER-PULL gives you headline performance without delay. For, you can get most for your money with Hobart. You can be better and faster work and with complete protection to the electrical system of the airplane. Its controls are so simple that anybody can operate it easily.

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The Hobart generator also coupled to the W-B engine, a rated 20.2 volt, 1000 watts, d.c. With two disc commutators and an armature type carbon pile voltage regulator, the generator delivers constant voltage at the aircraft bus regardless of load to add-on it provides three speed and frequency, over-voltage, reverse-current, and over-speed protection.

CONTROLS and ACCESSORIES

In addition to specified equipment controls, the unit contains at least of the device to give you everything necessary for the control of the generator. Even features include voltage control in the Hobart Type 2147 carbon diode hand fan actuated or, spot light that can be adjusted in a hand-held, chrome bakelite construction, but electric mechanism, an automatic meter type, "mole" type of oil change, service, oil and over-voltage and included in the standard cost.

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WASTEFUL ACCESSORIES
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1000W MOTOR DRIVER

Available in capacities of 350, 600, 1000 watts at 20.2 volt DC for shop and longer run where electric power is available.



2400W MOTOR DRIVER

Portable trailer type model able to carry equipment. For light line or other use independent of electric power.

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PROJECT BY specified Ejection Seats for a new Jet Bomber. These had to be designed to Military Specifications for use by Pilot, Co-pilot and Navigator-Bombardier.

WEBER ENGINEERING WAS TO WORK... complying with Military Specifications MIL-8-6136, these seats were designed for 32Gs, while maintaining the lowest weight factor and bolting specifications requirements. The electro-mechanical actuation gives complete air-brake adjustment for convenience and comfort. Ejection controls are in a compact enclosure in the seat rest, thus eliminating complex external linkages. One lever movement automatically performs the full complement of pre-ejection functions. A simple trigger squibs successfully completes the ejection.



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M LOGISTICS

lated the fact that it could operate a scheduled overnight service between its depots and various shipment points for about half the cost of commercial rates.

The earliest operation cost about 11 cents a ton-mile compared with about 23 cents a ton-mile for commercial airfreight.

AMC originally intended to operate Mustang with USAF-owned aircraft as a consequence had been by reputable aircraft. However, in the interest of time, AMC agreed with USAF to begin the service with civilian-owned C-46s. The modern hull of the service began last April and is operated by American Inland and Export Co., Miami. The entire service is flown by Capital Air Lines, Nashville, and began June 1.

Mustang provides five C-46 round-trips (11,000 lb. payload) weekly between all of AMC's major depots and its aerial points of embarkation, with the exception of the run between Hill AFB (Utah) and MacDill AFB (near Seattle) which gets only two trips a week. The service is flexible and can include cargo scheduled times where urgently needed parts are items factored, when necessary.

A feeder network of surface and air transportation has been developed to funnel high-priority cargo onto Mustang Service via the depots. AMC headquarters establishes schedules and load allocations, manages the service and provides route information. AMC depot personnel handle Mustang cargo at each stop.

From Mustang, as its parent modestly says, AMC hopes to get:

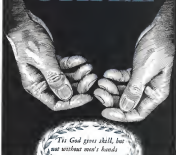
- Efficient information on current and future requirements for airlift.
- Faster pipeline time on its high-cost three, medium, and port needed



GLOEMASTER vehicles high-priority cargo in support of M-4 group in air.

VITAL, INVISIBLE PART OF EVERY CORNELIUS PRODUCT

SKILL



"The God gives skill, but not without man's hands"
... GEORGE ELIOT

Skill is the welding of a man's mind with his hands. Whoever you are, you will never see the skilled hands that manufacture Cornelius products. For they are many, of many skills. You will, however, see proof of their skilled talent in the reliable performance of every product that bears the name Cornelius.

The skill, of which we speak so proudly, is the kind that infuses man's search for perfect craftsmanship. Vital, but unseen, it's yours in every Cornelius product.

Because it makes sense to seek skill, it makes sense to see Cornelius for information and assistance on any pneumatic problem. All our skill is ready to help you.



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AMPHENOL's electronic applications are separate "divisions" for convenience. Included in this division are: AMPHENOL complete connectors, AMPHENOL MIL and RP connectors, AMPHENOL "miniature" and special connectors. AMPHENOL is responsible for the electronic application.

AMPHENOL's engineering for quality and production for military results in both the excellent reputation and the widespread acceptance of the AMPHENOL component. Trust upon the reputation of AMPHENOL components in the electronic products of your organization.



RESCUE COPTER is used in emergency duty as Douglas C-119 cargo transport.

part of its operation will be a drastically reduced payload, notably restricted from ANAC headgear and using an air of highland stress in Spain as standard procedure with only low cost stress arriving by sea.

Commenting on the proposed Spanish outfit one high-ranking ANAC officer said:

"Our past experience with night test programs gives us confidence that in the Spanish operation, logistical relief of high value force will graduate from an experimental concept into an actual reality."

■ NC-99 Accomplishments—ANAC also has been preparing for the future in the operation of large logistic transport of aircraft that USAF already has under development. These air transports of the auto-distant future will have payload capacity of 100,000 to over 200,000 lbs.

While ANAC is prepared to establish its second pipeline with the C-46s and C-54s immediately available, it has been using the giant Convair NC-99 transport operated by the San Antonio AAMA, to accumulate operational experience and explain the problems of a truly heavy logistic carrier.

When the NC-99 was delivered to USAF in 1949 it was regarded as a white elephant with little utility. It was assigned to Kelly AFB, headquarters of the San Antonio AAMA, in September 1950. Then, Maj Gen. Clarence B. McShaden, then AAMA commander, and a few fellows in aircraft logistics, developed a program to use the NC-99 as a power pig in an operational evaluation program for heavy logistic carriers. This program was completed last month and showed the following achievements for the NC-99:

- Logged 4,165 flying hours on 508 flights.
- Carried 36,337,341 lb. of United States military cargo.



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The modern STRATOPOWER Hydraulic Pumps are ready and able to perform efficiently well beyond heights penetrated by piston aircraft. They've proved it in Fockers, Guided Missiles and under the simulated conditions of the atmosphere STRATOPOWER Pumps pump! They are built to perform at full efficiency and with complete dependability under the extreme conditions and variables imposed by projected speeds and service ceilings.

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Keeping U. S. soldiers "in sight" is one of today's vital jobs performed by helicopter Army aviators. In training, these pilot-crews act not only from flying. They receive instruction in all military maneuvers—tactical, Medical Transportation, Aerial, Communication and Engineering, as well as Artillery.

And to handle a variety of military jobs rapidly, they need an airplane as versatile as their training. That's why many of these aviators opt for Cessna L-19 "Bird Dogs." Compared to the L-19, the new L-17 "Two-seater" is fly, easy to service, powerful and dependable. Today, Cessna is building a L-17 in a quantity for U. S. Armed Forces.



Hard to Hide from Here



Aerial photographs, properly interpreted, reveal even the most expertly camouflaged men, equipment and installations. Off-camera, Cessna's high-speed, low-flight characteristics and 315 horsepower performance, Cessna L-17's are frequently chosen for important, precise reconnaissance missions. They carry enough power equipment to transmit ground and air data and are suitable for detecting both officers and soldiers too.

When Quick Answers Count

Quick accurate information, the first need of every field commander, is quickly supplied by Army aviators flying Cessna L-17's. These highly maneuverable airplanes operate in and out of short, rough fields close to the action, are also valuable for wire-line emergency equipment supply, courier trips, controlling military highway traffic, even evacuating the wounded.



CESSNA AIRCRAFT COMPANY, WICHITA, KANSAS

LOGISTICS

States Air Force says.

• Reached a low of 11.2 cents per ton-mile operating cost.

During this period, the XC-99 demonstrated many facts of operational feasibility for a big transport. It landed fully loaded on a 1,400-ft. runway at McClellan AFB and took off with a 104,000-lb. payload from a runway at 5,000 ft. altitude. On one of its legs it hauled the complete ground equipment of a fighter wing (95,501 lb.) 2,556 mi. coming across the continent.

It operates nearly one weekly 5,000-mi. roundtrip between Kelly and McClellan AFB at Sacramento, with a resupply Kelly to Haney AFB in Pacific River lower country. During April 1953 the XC-99 flew 1,330 hours on 108 flights carrying 115 million ton-miles at an average cost of 13.12 cents per ton-mile. Direct maintenance costs were 2.51 cents per ton-mile.

►XC-99 Modifications In July 1953 the XC-99 underwent extensive modifications to incorporate the results of experience gained during its initial operations. Now B-24-51 equipped with direct ratings of 5000 lb. were installed, landing gear was strengthened, an integral landing elevator and self-tensioning system for upper deck bracing were added to facilitate cargo handling.

Payload cargo bins were developed to fit the XC-99's upper deck, forming the larger cargo box for cargo such as jeeps, aircraft engines, etc. Ingress door with the payload bins has been increased from 12 to 16, and a 100,000-lb. payload transport assembly designed to use the bins could be fully loaded in 10 minutes.

►For the Evans-16 out of five AMC-USAF engineers and studies probing the possibilities of aerial delivery of supplies said to produce the following feature trends:

- More applications of cargo units as a service, work of USAF supply.
- Increasing use of USAF-owned transports at a high rate rate or utilization. Measured by cost as direct costs to provide a permanent organization of USAF cargo units.
- More efficient use of military air transport resources now available.
- Reduction of procurement on high-cost aircraft equipment, because of better utilization in smaller quantities through aerial pipeline and light air transport cost.
- Development of bigger and more efficient air transports and both aerial and ground handling equipment for air-transportable cargo.

These trends will mean faster and more efficient support for USAF's long-range combat units and further step toward the realization of "Super Air Force per dollar" through the reduction made possible in procurement of critical high-cost equipment. ■ ■ ■

Quick facts on aircraft cleaning

The Wyandotte products listed below will:

- 1 Improve maintenance cleaning 2 Speed up production

AIRCRAFT MANUFACTURE

PROBLEM	ANSWER	DESCRIPTION
1. Washdown cleaning	Alkane®	Alkane® non-abrasive, non-toxic, alkali cleaner removes scaling dirt and soil.
2. Bristlebrush cleaning prior to spot washing	WAF	Non-abrasive, non-toxic, alkaline, reduces need for brushes of abrasive cloth.
3. Non-porous cleaning	WLB-7	Heavy-duty wash cleaner for magnesium, steel, copper and brass.
4. Removing heat-treated scale from aluminum and/or tempering heat-treated aluminum	WAF Acid	Expensive descaler hydrofluoric acid water and safer to handle and use less caustic.
5. Paint touch-up	Hydral	Preventive coating. Cuts down cost, simplifies touch-up work. Breaks up spray on.
6. Watermark paint touch-up	Flux	Very good cleanser against ink and chrome ground. Acts as dye bleach.
7. Spot-priming	E-L	Heavy-duty alkaline cleaner for cleaning steel before plating. Exceptional detergent.
8. Final cleaning	Barnes	Add to water in final rinsing for brighter metal finish. Removes light brassy.
9. Rear observation booth clip	Dural	As oil prevents rear observation, water spray detergent, only at lowest cost.

MODIFICATION AND MAINTENANCE

PROBLEM	ANSWER	DESCRIPTION
10. Grease cleaning	Alkane	Cut down formation, remove all types of soil from aircraft surfaces, engine, engine.
11. Bristle cleaning	WLB-7	Non-abrasive, non-toxic, alkaline, reduces need for brushes of abrasive cloth.
12. Carbon cleaning	P-1073	Non-abrasive, non-toxic, alkaline, reduces need for brushes of abrasive cloth.
13. Unplated fuel tank cleaning	SPW	A "universal" cleanser for cleaning all types of metal, including aluminum.
14. Reassembly external units	WAF	Removes oil, grease, dirt, and other contaminants. Cleans, shines, brightens, and prevents corrosion in aircraft external units.
15. Washing engine interiors	Alkane®	An excellent alkaline cleaner for regular aircraft maintenance.
16. Acid cleaning	WAF Acid	Alkane® acid neutralizes alkali, prevents corrosion in aircraft external units.
17. Engine test cell cleaning	Alkane®	An oil soluble cleaner for removing dirt, oil and grease from engine surfaces.
18. Washing machine cleaning	WAF	A special low foaming, non-toxic, alkaline detergent, cleans, brightens, and prevents corrosion in aircraft external units.
19. Aluminum brightening	Alkane®	Brightens for interior aircraft surfaces. Cleans and brightens in a single operation.

Page 100, Part 100

For information, circle the number on the coupon for each product you're interested in. It will refer you to a Wyandotte Chemical Co. representative in your area.



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WITH DETACHABLE, REUSABLE "Bottle green" FITTINGS

- UP TO 44% LIGHTER than MIL-H-5511. Aeroquip 601 engine hose features new thin-wall construction. Aeroquip "bottle green" fittings provide additional weight savings.
- UP TO 41% MORE FLEXIBLE than MIL-H-5511. Aeroquip 601 engine hose has a full cover stainless steel wire braid outer cover over a reinforced inner liner tube. This allows tighter bend radius, reduces hose length, saves installation time.
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"Bottle green" FITTING FEATURES



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Manufacturers of Aeroquip flexible hose lines, couplings, reusable fittings, self-lubricating couplings, pressure aluminum fittings. Aeroquip products are used in a wide variety of applications. Aeroquip products are used in a wide variety of applications.

How AMC Fills Overseas Lifelines

A ship plugging through the heavy south of Okinawa... a transport plane winging between Dobo and Wala... a truck rulling down a dusty road in Indonesia.

All of these are part of the lifelines through which Air Force supplies flow overseas to USAF units in Allied command of the Mutual Defense Assistance Pact (MDAP).

Port Controls—Airside these lifelines, keeping the channels flowing from the U.S. to overseas depots, are four offices of the Air Materiel Command. These are the Overseas Logistics Control Agency, located at Newark, New Jersey; Okla. City; and Sacramento.

Now, across the Northeast Air Command and the Air Materiel Force in Europe with its large depots at Barrow, England; Chateaufort, France; and Felling, Germany. Sacramento serves the East Air Force logistics force with its bases in Japan and Okinawa. Okinawa is the funnel through which the pipeline to Alaska flows. Supplies destined for Ceylon or South America USAF activities flow through the Mobile Air Materiel Area and the port of New Orleans.

Overseas Funnels

These offices are charged with the important and often formidable task of getting air assets to the Zone of Interest (ZOI) for combat support.

USAF commands operating outside the U.S. funnel their supply requests through one of these four agencies. It is a fact the responsibility of the control agency to enter the supplies from the proper depot and arrange transportation to the command which ordered the supplies.

High Traffic—The fact that these areas, 100,000 square miles, are the supply channels to the Far East, for instance, emphasizes the magnitude of the task. The Overseas Logistics Control Agency (hereby the Overseas Logistics Control Agency) handles the Overseas Logistics Control Agency's most important task: positive control of each of them.

"Without BOM machines, we could not operate this system," says Ralph J. Gower, deputy chief of the office at Sacramento. The office is headed by Maj. J. H. Taylor.

The system is based on a standard set of supply codes and is known as the case and item control system for overseas support.

How It Works—It operates in this manner. The overseas depot, which might be the Far East Logistic Command in the case of Sacramento, transmits its requisitions to the Overseas

Logistics Control Agency by radio. All requisitions are transmitted by radio, with the exception of stock replenishment items which are requested by airdrop.

The depot then determines the supply source in the U.S. for the item requested. The item might be one available in the Sacramento depot, it might be from another AMC depot, or it may come from the Army or Navy depot.

The control agency then directs the item to be shipped to the command which requested it. The agency decides whether the shipment is to be by air or surface.

On top priority items, the supply must begin supply action within 10 days. On stock replenishment items, the action must begin within 30 days.

If it is necessary to order the item from the manufacturer, the overseas depot is informed of the date when it is expected to arrive. If it is needed sooner, the requisitioning command tells the control agency to speed the delivery date.

Shipping Flexibility—The system in this AMC to delay until the last minute the decision as to whether to ship by air or water, thereby giving the logistics system the flexibility necessary to meet emergency demands. Every overseas destination is on an air logistics channel.

Each command has a certain amount of supply stockpile on hand by the chief of transportation to the theater commander. This is in terms of goods available to the command on Military Air Transport Service (MATS). The command then re-delegates this stock to the Overseas Logistics Control Agency. Through constant telecommunication with the overseas command, the control agency is advised of the date needs of that command.

When a supply source is ready to ship a requested item or item set to the command it then asks the control agency for its authorization. Only at the moment in the last decision made as to whether to ship by air or surface. Thus the decision can be based on:

• The need of the command at that moment—which might differ from its need a week before.

• The amount of allocated air space according to that command.

If the decision is to ship by air, the case then is space blocked for the item from the supply point in the ZOI to the requisitioning command.

Due to the close timing of this system, any decision to divert a shipment to water is made at the time when it is being packaged, thereby eliminating the cost of later repackaging.

A special code number is assigned each case when it is packaged.

Close Control

Through its complex BOM coding system, the control agency is then kept informed of every pound on route to its final point of utilization (APOE), every pound on hand at the APOE and every pound already shipped. Thus, it knows the cost balance of air transport left for each command for the month.

Follow Through—The control agency keeps the overseas depot informed of the progress of each requisitioned item, so the depot knows when it moved from the supply depot to the APOE.

The APOE or point of utilization (POE) advises the control agency when the case has been shipped and its estimated time of arrival at the overseas destination. This information (location) is passed along to the overseas command.

In the event a ship or plane is lost to enemy action or other cause, the logistics control office knows exactly what was lost and can quickly order the supplies.

Due to the close control, the logistics office can anticipate and determine items in the supply channels as needed. If weather or individual failures should ground aircraft at an APOE, thereby taking up space at the arrival point, it can shut off further flow until the trouble is cleared up. It can then, by using higher priority cases along the direct supply line, determine:

• Each positive item control makes it obvious which BOM equipment provides the backbone of the operation. It would be an impossible operation without the positive control of items.

New Arrivals—When pre-positioning of supply support is required, as in the case of a new point of arrival, the theater, the depot with the prime weapons responsibility determines the amount of items necessary for the initial 90 days of operation.

After this, that policy, regardless of what those 90 or so aircraft need for 90 days is given by the Overseas Logistics Control Agency responsible for that area.

From then on the process of ordering and shipping is the same as through the request chain from the overseas command to which the aircraft are being shipped. ■ ■ ■



LARGE DIGITAL COMPUTER, like this Remington Rand Univac model at Air Materiel Command headquarters, will enable

Electronics to Streamline AF Logistics

Electronics, which has revolutionized aerial warfare during the past decade, appears destined to do the same for Air Force management, logistics, and supply during the coming decade.

The Air Materiel Command is turning to electronic digital computer and data processing machines to boost its operating economy, efficiency, and to speed the flow of supplies to hundreds of its long bases.

AMC is pioneering the application of electronics machines to the "world's largest department store and mail order house" (except possibly for some military armory). Compared with a large department store, which may stock 100,000 different items, or the Sears' catalog which lists 100,000 (comprising a range of sizes in one item), AMC handles approximately 1,100,000 different items. Industry and business, particularly in the retailing field, are watching the electronics system trail which AMC is blazing for application to their similar problems.

'Paper Mountains'

Today, approximately 85% of the total time involved in obtaining supplies is consumed in filling out, handling, and transmitting paper work, according to Miss Gail Phillips, AFSCM, AMC controller. Only 20% goes into the actual moving of supplies. At present, AMC must reprocess paper procurement requisitions for more than a million different items every six months of the time they will be needed, using consumption data which is frequently months old.

■ **Business Service.** Electronics machines will change this. Probably within the next decade, a supply officer at some remote base will enter his requirements by punching buttons on a device no-

scribing a small adding machine. The order will be instantly transmitted electrically and routed to the proper depot, possibly thousands of miles away, which handles such supplies.

The requisition may then be transmitted, upon automatically, to an appropriate section of the depot warehouse where another machine will print out the information, including the necessary shipping label. Within very few days the supply officer has punched out his order, laid a world away, the required material may be on its way to the depot's shipping department.

Except for retrieval handling, the entire transaction will have been completed without human intervention and delay, without stress of paper work. Whenever permanent needs of the transaction are needed, supplies will just sit there, ready to be shipped.

■ **Automatic Inventory Control.** When a requisition is received at a depot's electronics center, it will be checked automatically against available stock of the item—quantity records probably will be stored on magnetic disks or tapes. Based on the manufacturer's procurement lead time for the item, the number of items in stock at that and other depots, and the current rate of consumption, the machine will determine when the item should be re-ordered from its manufacturer.

This automatic inventory control

will be able to provide depot personnel with daily lists of items which need to be re-ordered, together with the estimated quantity needed for, say, the next three-month period, based on present consumption rates.

Initial planning for a world-wide electronics supply system is already under way at AMC. The Logistics Systems Research and Planning group, headed by Col. G. C. McDermott, is working closely with logistics personnel of the Road Corps, and with electronics and business machines manufacturers. By the fall, the group hopes to have a joint command study.

■ **Computer Already in Use.**—The AMC is not sitting back and waiting for its long-range world-wide system. The command is already using large electronic computers, including a new Remington Rand Univac recently installed at AMC headquarters, to solve complex logistics, maintenance, and management control problems.

For instance, the Fiscal '56 budget estimate for airborne equipment requirements, involving possibly half a million items, was completed in one day on a Univac, from individual depot figures. The same problem had formerly taken several weeks to solve using punch-card machines. (An additional three months were required to program the problem for Univac solution, require the same programming time required for punch-card machine solution.)

Another comparison, to determine the product of being lower and better power for all USAF aircraft, was completed in 21 minutes on a Univac. Using punch-card machines, the problem would have required seven machines

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BETTER BUSINESS METHODS

For Greater Profits Through Lower Costs

Efficient and Inexpensive Purchase Order Follow-Up Clinks at Libby-Owens-Ford

This Company processes open purchase orders with a minimum of confusion, excessive time and expense, by using simplified Visible Top Follow-Up Folders with printed data scales. All orders are followed automatically by clerks on visualized



dates. Orders are filed by vendor's name for easy reference, put the visible signals make follow-up easy. Kardex signals lock into position for positive control, yet can be changed easily. The same folders are used hundreds of times and the same clerk handles a given order for its entire "open" life. This system covers any application where follow-up is essential. See LIB563 Rev. 1.

Sound Maintenance Plan Slashes Costs; Assures Equipment Productivity

Folder X1383 Rev. 1 describes graphically a Maintenance Control System that is currently cutting maintenance costs while boosting equipment productivity in many well known plants. This Plan fulfills



the five most requirements of any workable maintenance control system, including written work orders, scheduled work, equipment records, stores control and corrective reports. Read about it in X1383 Rev. 1.



How an Aircraft Manufacturer Completes a Payroll for 16,000 Employees in 2 Days

This Punched-Card Electronic Computer is the key to the high-speed payroll operation operated by a leader in the aircraft industry. It makes all computations to produce payroll register cards, and check-writing cards, with complete figures for the weekly gross pay, net pay and taxes—as well as bi-date figures for gross pay, Federal and State taxes and net pay on taxable and non-taxable wages.

The payroll register and payroll

checks are simultaneously processed, on separate tabulations, to complete the entire job in two working days, with time to spare.

This Klett code Computer delivers comparable performance while handling the mathematics of gross-to-net control, solving equations in microfilm, or preparing cost analysis.

There are only a few of the profit-boosting uses that leading aircraft manufacturers are finding for the Remington Rand 440 Electronic Computer. For more detailed information on how to apply this equipment to your own computing problems, circle COMPUTER on the coupon.

New Printing Calculator is Fully Automatic

For financial charts, traveling overhead, and for many other business charts, print after print is turning to the new, fully automatic Model 98 Printing Calculator. This "Don't" leaving phenomenon features automatic division and multiplication, plus 16-key touch addition and subtraction, with all proof printed on 8 1/2 x 11 in. black and standard red. Printed tape proof and 16-key touch method operation assure greater, more accurate output. Get all the facts on this new event in figures on progress from folder C689, offered as the coupon.

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■ LOGISTICS

weeks and 250 man hours, Geo Smith says.

AMC has also used electronic computers to calculate life expectancy tables for jet engines and the amounts of basic industrial materials which would be needed in an all-out war (in a function of time) to permit an orderly buildup of military output.

► **AMC Computer Center-Problems** Like those, which previously were solved by approximate methods, linked defense functions for management use, as were subordinates at all, will now be solved on the new AMC Univar. The Methods Research and Analysis branch, (under the Computer's Office), headed by Lt. Col. C. R. Gregg, is charged with "test and learning" of the new Univar. One of Gregg's tasks is to find new operational problems which can be advantageously solved on the speedy new computer.

On an average problem, Univar is 40 times faster than punched-card machines, but in some types of problems, its speed advantage may run much higher. But more important than speed alone is the ability of the machine to perform long sequences of rapid operations at rapid speeds without human intervention.

Although Gregg's office is concerned with immediate applications of Univar to existing problems, and McDowell's group is engaged in long-range planning, the two are expected to work closely together. Newer computers, such as the IBM 702 which AMC hopes to rent, will be put to use and evaluated at several other depot and base locations. Univar will probably be used as a test bed for McDowell's systems engineering studies.

► **Speed Important**—The high speed of electronic computers really pay off in budgetary calculations where the end result must reflect latest military requirements. In a past, when slower punch-card machines, a lot later AMC was unable to prepare its last January budget, covering 320,000 different items which it processes and another 400,000 which it buys from the Army.

At any point in this seven-month cycle, a change in status, requirements, or a change in a complete revision in the budget. For example, an increase in the number of bombers, or the expense of transports, is reflected down to each stage in the number of spare systems and types which must be purchased.

Even after this initial budget is prepared, overall USAF or Defense Dept. considerations may send it back to AMC for fast revision. Finally, budget cuts made by Congress require further revision and adjustment before AMC can start procurement. With the application of electronic computers and data processing devices Geo-



PRINTING to speed Univar output.

and Smith believe that AMC can greatly reduce its budget perpetuation cycle.

How It Began

Air Force interest in applying high-speed computers to its management and production problems began in 1947, shortly after the first electronic computers were developed.

In the Pentagon, when Gen. Banfill was USAF controller, the USAF Planning and Research Division first studied the possibility of using computers to reduce war plans into alternate budgets and funding allocations. For instance, how many aircraft, bases, air-sea, fuel, test equipment, fuel, spare parts, etc., are required to support a bomber wing? These initial studies were made by Marshall Wood, now with the Defense Dept. and Dr. George Dantzig, now of Rand Corp.

In 1948, under Col. McDowell, the Planning Research group of 40 mathematicians, statisticians and logicians began analyzing interdependency relations, using techniques sometimes called "input-output." For instance, if a million-dollar engine is placed into an aircraft manufacturing, what percentage of the money finds its way into other segments of industry, such as iron, steel, engines, accessories manufacturing? Also, what percentage filters down to suppliers of such raw materials as aluminum, steel, copper, and others?

► **Early Techniques**—At the time, complex problems like these, linear programming math techniques were developed, could not be processed effectively on then-available computers. A simplified triangular matrix system was devised and found, using punched-card machines in 1949. In 1950, the group got the opportunity to use the newly designed Bureau of Standards SRAC computer on these problems, in a way pleasing better than SRAC was developed with USAF funds.

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Paragon got its share, one of the first of the new high-speed computers to be produced in quantity. This machine has been used to compute requirements for non-renewable items, but later programming techniques, support development of official USAF programs, solve operations research programs, etc.

The same year, Wright Air Development Center launched a program which resulted in a contract (let in 1953) for the development of a military electronic flow device (MFTD) at the Manassas Computing Machine Co. MFTD is an experimental digital computer designed for natural inventory control of a large airbase. Delivery is presently scheduled for August 1955.

Logistical Objectives

AMC has given its new Logistical Systems Research and Planning group a broad area to explore, as evidenced by some of the objectives listed in its charter:

- "Sponsor or conduct research for improved mathematical techniques, tables, data, and techniques to provide better requirements determinations, budgets, procurement control, programming, accounting, distribution control, maintenance control, and disposal determinations through the use of electronic computers and data processing equipment."

- "Serve as a point of contact for co-ordinating information on directives, regulations, or manuals affecting joint or logistic systems and techniques in major AMC functional areas which are currently or later be more effectively performed electronically."

- "Sponsor or conduct research into the logic and anatomy of data recording, collection, and reporting throughout all AMC functions with the objective of reducing current expense and preventing excessive cost for the design and production of electronic computers and data processing equipment."

- Operating Frameworks—AMC has already established criteria for computer use as a world-wide electronic system, including:

- Data input at various points on an airbase must be transferred directly into the overall data processing system and should require a minimum of translating devices (no current data from cash to tape or vice versa). Considerable thought is going into the subject of best-level data input devices and what form they should take, McDowell says.

- Standard electronic machines developed by industry at its own expense and having commercial applications in production, must be used. This will save the Air Force the cost of developing development of specialized machines, permit it to borrow industry's machines

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TELECOM speeds tele-type communications between AMC depots and mission bases.

as the cost of national emergency.

• An absolute minimum of human intervention should be permitted in the system. This means that all electrostatic actuators, possibly made by a variety of manufacturers, must be able to communicate with one another without requiring human translation of electromagnetic points. The only human intervention permitted should be for the cessation of programs, which cannot be synthesized with computers.

• Systems must be versatile and have adequate capacity eventually to handle numerous inventory properly accounting, maintenance scheduling, control, periodic replenishment accounting, and other operational data. Present indications are that the system must accommodate hundreds of decimal digits or hexadecimal characters per stack memory item. The next is much greater than what is possible with present generation units.

• Data Center Location—One of the knotty questions which McDowell's group is pondering is: How many data processing centers should there be and where should they be located?

One possibility is to put a center at each of the 15 AMC depots and AMAs. Another is to set up few centers, one each for handling aircraft, engine, avionics equipment, ground support and ground supplies.

Another possibility calls for three centers—one for high-end, medium cost and low-end items. The thinking behind this arrangement is that fewer transactions and more data per transaction are involved in the high-end items than for low-end items. A single centralized data center appears unlikely because it

would prove too valuable, McDowell says.

Rapid Advances

It was only five or six years ago that AF's Planning Research group at the Pentagon was thrilled because its mathematical models were beyond the capabilities of computers of that day, McDowell recalls.

Recent developments, such as high-speed processors (to record computer output), improved input equipment, and greatly increased storage (memory) capacity permit to scale "yesterday's dream a mile," McDowell says.

• They Won't Talk—In fact, keeping pace with the computer is one of McDowell's biggest problems. The art is to not let the computer take over as a computer, that some common sense, particularly the staff's, are reluctant to disclose their own ideas, he says. To assist in this, AMC and Wright Air Development Center have requested a joint project effort.

To keep abreast of new developments and to keep the industry pointed in AMC thinking, McDowell and his group are working with the products and staffs of major business machine companies to analyze AMC needs and to enlist members in their product planning and business applications studies.

By this fall, McDowell hopes to have several systems plans at the point where budgets can be prepared and funding programs started. When the Monnet MIFD is delivered next summer, it will probably get a trial at some AF base, to test advanced data handling tech-



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LOGISTICS

agers. If AMC ever obtains one of the new IBM 702s in fact, it will probably be installed at some AMC depot for a similar evaluation.

Personnel Problems

The mushroom growth of the computer industry has caused a serious shortage of personnel capable of developing mathematical models of the problems to be solved, called "problem formulations, programming the problem for computer solution, and operating and maintaining the machines.

■ **Non-Professionals**—A year ago, Lt. Col. Gregg and his staff found the prospect of developing a group with the technical capability of operating and maintaining AMC's Univac, despite the nationwide shortage of qualified personnel. He decided to experiment with the hiring of non-professionals (without much or engineering degree) who had had considerable experience in programming AMC's punch-card machines.

Today, approximately half of AMC's IT Univac programmers are those non-professionals, and Gregg says the policy has really paid off. Criteria on the 50-man staff include 19 engineers, 11 with degrees in math, physics, electrical engineering and other technical fields.

■ **On-the-Job Training**—More than a year before Univac was scheduled to go into operation, the first AMC personnel were sent to Rosamund Road training schools. This was followed by on the job training with Rosamund and the Pentagon's Univac.

The AMC group initially attacked small problems as small, simple portions of large problems, programmed them on tape, then ran them off as the Rosamund or Pentagon Univacs to check their techniques. The largest problem programmed to run is due by this group in the Fiscal '56 budget for military space parts.

Probably the most difficult parts to fill in a computer center are those of previous formulation. These are the men who must convert the problem-solving task not well-stated—into a series of logical steps, from which the programmer prepares the coded machine instructions. Gregg hopes to develop a small nucleus of mathematicians who can develop an easy machine-code technique to enable Univac to handle a wider variety of problems.

About Univac

AMC rents its Univac system from Rosamund for about \$23,000 per month, with an option to purchase whereby a portion of the rental will be applied against the purchase price. The machine, operating at a pulse rate of



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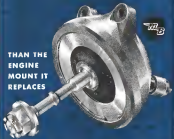
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21 sec., can perform 1,000 additions or subtractions per second. Univac can also perform 463 multiplications, 217 divisions, or 1,740 comparisons per second.

■ **Self-Checker**—The portion of the machine which performs the arithmetic operations is built in duplicate so each operation can be performed simultaneously in the two sections and the answers compared. If the two answers are not identical, indicating a malfunction, the machine automatically stops its calculations.

Short-term storage (memory) is provided by magnetic tape units, of which the ANC machine has eight. Each type is capable of storing data in 1.5 million decimal digits or alphabetical characters. Access time to any number in the high-speed memory is between 40 and 45 milliseconds. Approximately three minutes is required to scan all the characters on a reel of tape.

A single 10-in. reel of magnetic tape can hold as much information as 10,000 conventional punch cards, and requires only 16 in. of bench storage space. This is an important consideration with ANC which must store vast amounts of data for possible future selection.

Within the next couple months, ANC expects to get a new high-speed printer which should greatly speed up the process of getting information out of the computer, presently a major bottleneck. The new device can print 1,000 characters per minute, roughly 65 times the speed of previous printers. Another pending addition is a card-to-tape converter for automatically transferring information from punch cards to magnetic tape.

No computer description would be complete without mentioning the system of tubes and dander mod. Univac uses 14,000 tubes and 15,000 diodes.

■ **No "Clock" Issues**—You don't hear the terms "locking machines" or "clock trains" in conversation with Smith, McDowell, or Craig. The want to stay away from any of machinery which might cause all hand-headed military men who could make good use of Univac.

One of Craig's tasks is to educate ANC personnel on Univac's capabilities, what kind of problems it can solve. In this respect, Craig emphasizes that Univac, and similar computers, should be used to provide complete management tools, and merely coordinate more basic reports which military managers need most.

If management will specify the information needs they are looking for, and the criteria that can be used to spot them, chances are that Univac can be set up to spot these trends while it is solving the basic problem. Craig says:

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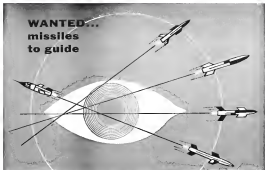
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Packaging Keeps Pace With Air Cargo

By George E. Christian

The growing need toward air transport of cargo has helped make packaging for the United States Air Force big business. According to figures not released at Air Materiel Command headquarters, yearly packaging cost is approximately three quarters of a billion dollars; expressed in another way, the Air Force spends about 6 cents of each purchase dollar for packaging the equipment it buys.

To put this air transport of cargo in its proper perspective, one need only look at the rapidly growing shike of transport and truly centers that double in cargo cost.

Now flying on daily freight planes are the great Douglas C-124 Globemasters, the twin-engine Fairchild C-119 Flying Boats, the Boeing C-97, Douglas C-54 and C-47, and Curtiss C-46.

Looking ahead, there are the C-113, now under construction at Fairchild, and the West Coast Packaging firm Lockheed's C-130 and Douglas C-112 and C-119.

New T.O.

The new importance of packaging recently led the Air Force to take a long hard look at its packaging methods and came up with a new technical order (T.O. No. 44-155) and new packaging ideas which are completely reorganizing its packaging methods.

Savings sought—The three basic objectives: save money, save weight (here, use space) (here).

A chart located just at the T.O. greatly simplifies the task of how to package a given item and is "a combination of a whole book shell of packaging instructions," says Col. R. L. Mason, Chief of Packaging Branch, Transportation and Packaging Division, Directorate of Supply and Services, Air Materiel Command.

Called the "Container Selection Chart for Air Shipment," the chart tells a packer at a glance how to select a container and what type of packaging should be used for the shipment at hand. It tells how best to package the unit in the most economical way from a weight and space standpoint, consistent with delivering the article in serviceable condition.

In a parallel endeavor, AMC is constantly looking for lightweight materials which are suitable for its packaging needs.

Example is lots of newly unobtainable polyethylene bottles in liquid containers.

And Fiberglas promises to be a good, lightweight substitute for steel containers. It prevents making homesteadly tight seals, yet is strong and highly resistant to leakage.

Take the field of rocket containers. The Air Force is now buying these containers under a new performance specification, MIL-C-4790, at a dollar saving of nearly 50% over the old style containers. These containers are purchased "by the thousands," so the economies are large.

Weight and space savings are equally impressive. T.O. 44-155 has resulted in a two saving of approximately 66% (five per 100 lb shipment was cut from 45 to 15 lb), while weight has been



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■ LOGISTICS

related by approximately 32%.

These weight and space savings are available in growth-oriented freight port plane efficiency because each plane can carry so much more equipment now that the weight and size of the surrounding packing has been so sharply cut.

Questionnaires

Another program initiated at approximately the same time to the tune of the T.O. (Jan. October) was the distribution of thousands of "Packaging Questionnaires." These are addressed directly postpaid with each issue, to be filled out by the person receiving the package.

To date, AMC has had returns on over 24,000 cards, says Col. Mann. The good response was led by Gen. Banfill, AMC's Commanding Officer, who sent personal messages to each major Air Force commander, asking for organizational support of the shipping program.

Intensifying oversight of the program is that, of the over 24,000 cards returned, only 130 reported that the time in question was unreasonable. Another 180 complained that the containers were too large and 128 made other miscellaneous comments (such as the item was poorly packed, lumber could not be heavier than necessary, too much soap going on the inside, etc.).

► **Fingerprint Problem:** The card system quickly shows where packaging is adequate or poor. If the latter, it also gives the finger as the individual responsible. If the method did not fit the individual it is at fault, the cards place the responsibility squarely where it belongs.

The card system can also show other important fact-based packaging of low-cost items which require less the simplest type of treatment. This too can result in considerable savings. As Mann put it, "The cards will allow us to tailor the package to the item being packed."

Typical complaint and "The boy system were packed in a 12-in. box with 5 lb. padding on 4." Typical of the height rule. The ten-pound light armor at the station is an excellent condition."

Questions asked on the finished cards include: "Manufacturer's stock no., is the item secure, if not, how secure, is it damaged, material damaged, treated, broken, rusted, torn, rotted, wet, other did you provide too much protection for the item, packed by (initials) additional comment, reporting base or installation."

► **Coding:** Cards—Still another system recently inaugurated by the Air Force to streamline its packaging and inventory procedures is the establishment of a Packaging Data Card system using

EAM (electronic accounting machine) cards. The cards are coded—eight different symbols show such information as the item's freight classification, method of preservation, quantity in unit, pack, etc.

The codification enables AMC to expedite shipments and justify with considerable accuracy just how much of an outfit will be required to move a given quantity of freight a given distance. Also the cards allow shippers to consolidate items of similar sizes and dispatch them together. This effects a real money savings because if items of dissimilar freight rates are packed together, the entire shipment is charged for at the higher rate.

To put the system going, packaging was started with all items weighing less than 200 lb. They found that there are over 600,000 items in this category alone.

Package Studies

Still striving for "more Air Force participation," Col. Mann proposed to other departments to size the program's dollar.

The Air Force decided that overseas shipment did not need waterproofing. This saving, waterproof packaging, given a good deal of money, because domestic plywood is considerably cheaper than water-resistant plywood.

Still another source, the Air Force is emphasizing to expedite freight movements a greater use of palletized shipments.

Operation "Opportunity Airlift" is another necessary move. This is the term used for training flights which check out or substitute light arms and say at the same time carry cargo.

These flight flights are, of course, scheduled.

AMC recently increased the maximum weight of items shipped in individual containers from 25 to 50 lb. allowing cargo in this weight bracket to be packed in relatively light equipment boxes instead of the much heavier wooden boxes previously used.

A new universal jet engine stand has been put in production, according to Col. G. E. Kallen, Deputy for Plans and Operations, Directorate of Supply and Services. The stand will save a lot of money because it is designed just about any type of jet engine. It characterizes the accuracy of custom-building a different type of stand for each type engine, making that stand useless for any other engine and obscuring the stand with the engine, as it now does.

► **"Single-Trap" Container:**—AMC is marketing the "single-trap" one-shot container as the usable type to determine which is the more economical. It is most economical in the long run.

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LOGISTICS



ELECTRONIC EQUIPMENT is sealed in super-proof package, with desiccant added.

to buy large quantities of one-shot containers which will be expected to last for only one trip (although they may possibly last for several trips if undisturbed) and demand it, or follow current practice of buying relatively expensive, durable metal containers which have a long life.

AMC will have to take into account two drawbacks of the flexible container: they pose storage and repair problems. ■ **New Rocket Containers.**—The new-type container for the 2.75 in. Mighty Mouse rocket motor was recently purchased by the Standard Container Co., New Jersey, was accepted by AMC. It costs approximately one half as much as the existing container and it gives the rocket much better protection against damage.

Udell E. Berry, AMC Packaging Technician, told American West the new container saved \$1 million a year. It would have saved \$8 million had steel rocket post-rocketment not purchasing losses.

Old-style containers were made of drawn aluminum tubes, sealed at one end. They carried the whole rocket and were portable for use in a launch. The tubes were only closed in, damaging the rocket or making it difficult, if not impossible, to correct the rocket from the container.

The containers were sealed at the sides and with compression type release pistons which were subject to leakage if not properly installed.

Also the rocket was pushed while at different kinds of loads were desired, the rocket had to be dismantled and the proper kind of load installed.

The new container does away with all that. Also clustered in groups of four, then an order of 25, give the plate load with fiberboard. Each group of four is packed in a wooden box, giving great strength but costing a weight penalty of about 20%. The containers hold only half a rocket—either the head or the motor. Then the proper kind of

load may be assembled to a motor without resorting to any disassembly. The containers are made more rugged and consistently deliver the rocket in serviceable condition.

The new units are hermetically sealed and require no inspection for the first 12 years. Old-style containers required weekly or triweekly of the job. The containers are equipped with a non-rip cover, like a roller case, and is labeled a "single trip container with reusable feature—the top can be screwed back on and will give a closer guard for another six months."

The new containers saved lower shipping costs. This is because the rocket, which are cheap to transport, can go to one shipment, divided into the loads which are expensive to ship because of their expensive quality.

Previously, the motor traveled at the one high rate in the load.

■ **New Underbelly Container.**—AMC technicians have also come up with a new type of universal metal container which is used to carry delicate gyro and other types of sensitive instruments.

The old type can (of which there are 12 million in AMC's world-wide logistics system today) is made up of six parts: the rim, lid, rubber sealing gasket, ring, bolt and nut. It is difficult to install the ring as they separate the lid down on the rim to make a hermetically tight seal with the gasket in between. The seal is effected by tightening the angle bolt. If not done carefully, and if the lid is not tightly tapered around its perimeter during tightening, the seal may not be tight and moisture leaks in.

The new unit is called a "Tumb-Lock" container. Top bolts on the body of the unit by turning it through 90 deg. Lid is not turned several degrees by hand. To install the lid, one of four attachment ribs on the lid is bit loosely with a hammer. It is easy to make sure the lid is in the fully locked position by seeing if the separator web holes in lid and body line

RADIOPLANE ALSO RELIES ON OMOHUNDRO FOR FIBREGLASS PARTS



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LOGISTICS

up. The artificial was then run through both holes and sealed with lead.

AMC says that the old-style can is very unpopular with industry. The new style should do away with much of the unpopularity. AMC officials expect the new to replace the old entirely. Cost of the two cans is approximately the same. The new container will come in eight different sizes.

► **Previous Discount**—The Air Force recently adopted a new, precision packaging formula which, it estimates, will reduce by 35% the amount of desiccant now used to protect supply items from moisture. This means a yearly discount among all items \$125,000. The drying agent is packed in a container with the item to be protected.

Previous method was to include 10 units of drying agent in a container per one pound of containing agent, regardless of type of containing agent used, volume of box, etc.

New quantity of desiccant used is determined by volume of container agent, water vapor transmission rate of container, and quantity and quality of the desiccant or drying agent.

Under the new formula, AMC technicians have determined the desiccant requirements for the various containing agents such as wood, felt, cellulose, wadding, sponge rubber, bound wax and Fiberglas.

These requirements are set up in tables which spell out the specific amount of desiccant to be used with each type of containing agent. The requirements are applicable to both metal and flexible barrier containers and are designed to protect millions of packaged supply items during transportation and storage.

► **New Discount Procedure**—AMC has initiated action in Fiscal '55 to pass-up discount as a cost contract basis. This means that the manufacturer will ship the desiccant, in the quantities specified, direct from factory to the using activity. It will be shipped as one-imp. after drums instead of subcritical containers. The allowance is expected to produce at least a 15% savings in transportation, storage, labor and handling. Old packaging method was to buy large quantities of desiccant at a time, store it at great depths where it was shipped.

► **Conclusion**—AMC spokesmen say that the Royal Corp. of Santa Monica is making extensive studies in connection with all phases of the logistics system. The firm is giving considerable thought to air transportation packaging.

And AMC technicians, on their role, are working closely with industry specialists in the field of packaging and transportation to come up with the best packaging methods and materials available for the job at hand.

AVIATION WEEK, August 16, 1954



Martin Aircraft Forms Solid Ingots of Scrap Sheet Titanium with Sciaky Spot Welder

The Manufacturing Research and Development Unit of the Glenn L. Martin Company has developed a technique to utilize virtually all their scrap sheet titanium. A one-inch pile of 85 laminations of .004 titanium with two laminations at each end of .002 titanium is joined with one weld on a Sciaky type ZMCO 68T 900 KVA Three-Phase Spot Welder.

The weld instant forms a solid ingot of virgin metal at least as strong as the parent metal. This ingot can be machined into a variety of titanium parts. An expensive waste is almost entirely eliminated, and the months of lead time required for delivery of titanium for machining is avoided.

Martin Research offers another fine example of Sciaky basic thinking in design with resistance welding equipment to do more useful work at the lowest operating cost with maximum reliability.

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Here, MYCALEX 410 glass-bonded mica insulation, shown in an actual application, is used to insulate the coil and maintain its shape. The Mycalex Corporation is a member of the American Mica Association. It is one of the largest manufacturers of mica products in the world.

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SERVING THE AVIATION INDUSTRY



AMC-INDUSTRY TEAM's long Boeing B-47 Stratojet bomber being ref of fuel via slow roller to join Strategic Air Command

■ PRODUCTION

Aircraft Program Geared to USAF Goal

Air Materiel Command and the aircraft industry are engaged in the largest peacetime production program in history. It is aimed at the twin goals of expanding USAF combat strength to 137 wings and modernizing the active inventory of more than 20,000 aircraft. This program has expanded the aircraft industry until it is now the largest single employer in the manufacturing field, with 750,000 people directly employed and well over a million more people working for its subcontractors and suppliers.

To supervise this vast effort by the industry charged with developing and building new equipment for the expanded and modernized USAF, Air Materiel Command has had to streamline its procedures and develop new methods for swift liaison between its centralized controls at headquarters, decentralized operations in the field and the industrial organizations with which it works.

Key to these new methods is the growing importance of the Air Materiel Area and the recognition

of the need to establish fast, clear and decisive channels of communication between AMC and the aircraft industry.

AMC's job of production supervision is further complicated by the growing complexity of aerial weapons systems which have advanced and improved to such an extent that they require the addition of many new industrial skills to the traditional scope of the aircraft industry.

AMC is also fighting the battle against rising wages and material costs to get more Air Force equipment out of a limited budget. Development of better production methods for industry such as the heavy press program play an important role in cutting production costs.

While deeply enmeshed in the problems of current production, AMC is also charged with responsibility for developing plans and techniques to meet future industrial mobilization requirements in the event USAF is again called on to meet a full-scale national emergency.

How an AMA Speeds Weapon Production

By Irving Stone

Weapons—The modern aerial weapons, right up to guided details of structure, preflight, armament, equipment, and mechanical and electronic controls, pose a tremendous challenge to military planners and civil contractors and to administrators in both categories.

Involved is a mass of problems concerned with facilities, tools, production schedules, engineering changes, interchangeability, spares, modifications, and cycle maintenance. There are but a few of the items of difficulty.

In the production of these problems through efficient coordination with the aircraft industry, the Air Materiel Command and its lower echelon play an indispensable role.

► **B-47 Teamwork**—One example of this teamwork is the B-47 program, the largest single USAF postwar aircraft production job, requiring well-coordinated work of an AMC Air Materiel Area and three aircraft manufacturers. Other aircraft programs offer similar examples of teamwork, the largest difference being the size and scope of B-47 program, that required a special Production Committee, a coordinating group supervising the three prime contractors (Boeing, Douglas and Lockheed) and the AMC.

The original Boeing contract in September 1945 was for 16 B-47s. Later, the administration of that contract was taken over by the Joint Project Office set up by AMC and the Air Research and Development Command at Dayton to streamline the development and procurement of a new type of aircraft.

The Joint Project network came about when ADCD, the old engineering division of ADC, set up

B-47 production contracts has been delegated to other divisions within AMC. These echelons are primarily the Air Materiel Area (AMA) and the local AF plant representatives (working out of the Air Materiel Area) stationed at the contractor's facilities.

► **Role of AMA**—The AMA site established with prime contractor (eventually responsibility for procurement) of particular plants (regardless of geographic area where fabricated), acquisition, and AF support equipment (new tools, instrumentation, special tools for maintenance, etc.).

In the case of the B-47 and other Boeing plants, the Oklahoma City Air Materiel Area (OCAMA), commanded by Maj. Gen. W. O. Smith, has prime responsibility for procurement of spare parts for the B-47 program (demonstrations are sent to the plant representative for administration), support of the plant in the field, and administrative responsibility for the subordinate units such as the plant representative's office and its personnel detailed to that area.

► **Plant Rep's Office**—The plant rep's office receives policy guidance on all phases of procurement, production and inspection functions through OCAMA from ADC headquarters.

OCAMA also has contingents of all the division activities within the plant rep's office, to perform surveillance, determine operating policies and furnish actual physical assistance to the plant rep's division when necessary.

The plant rep's office conducts administrative control of all contracts assigned

to the particular contractor (Boeing, Lockheed, or Douglas, as the case may be). This control is split into various divisions—those dealing with contractual matters, production of aircraft, flight testing of production and experimental aircraft, quality control (inspection), facilities necessary to support the production program and property accountability.

The appropriate members of these functions may be represented also in the contractor's organization, which, of course, has the prime responsibility for backing the airplane.

Production Division

The plant rep's production division is a coordinating and expediting activity to insure delivery of aircraft on schedule. It accomplishes its mission by working with cooperation from other segments of the AMC procurement system and the contractor. Some of the activities of the production division include:

► **Coordination of contractor's schedule requirements** with Weapons Section Project Office for government furnished aircraft equipment (GFAR) such as engines, radio and radar gear, landing gear, and instruments. These are items over which the contractor has no control and are bought collectively by the government for the sake of greater economy.

► **Discussion with the contractor** and accommodations to higher headquarters of the necessity for additional facilities, such as machine tools, factory and office buildings, shop space, etc., to produce the plane according to the schedule established.

► **Expediting the solution** of technical problems which inevitably develop in



B-47 PRODUCTION COMMITTEE (l to r) Douglas Aircraft's Selwyn, Lockheed Aircraft's Holloway, AMC's Lt. Col. Fisher, Boeing Aircraft's Bombard.



BATO RACK, a modification, gives B-47 35,000 lb. added thrust at takeoff.



B-47 TACTICS off using additional thrust from Bato rack and water injection. Rocket units are dropped to free drag length.



WATER INJECTION, standard on new B-47s, adds thrust.



OLDER METHOD uses B5 internal Bato units.



BOEING'S WICHITA DIVISION production line is loaded with large components going into F-4E, the B-47 Stratofortress.



DOUGLAS TULSA PLANT shows busy final assembly line (below) for B-47. View above reveals 3,000-ft-long main building.



building complex modern aircraft. This effort usually involves any or all of the contractor's production, quality control and engineering sections, the responsible AFMA (in this case OGCAMA) and the Weapons System Project Office at AMC headquarters (which includes elements of ARDC).

• **Ensuring timely production of spare parts for aircraft support of planes which have been delivered to the combat wing.**

Quality Control

The plant rep's quality control division conducts continuous inspection from individual parts to the completed



AERIAL VIEW of Wichita facility shows part of Boeing's 446 acres here.

plane. Its responsibilities also include approval of the contractor's inspection system.

Primary purpose of quality control division is to insure compliance with the specifications governing the construction of the plane, and to insure that the aircraft are complete in every respect upon delivery.

The AF inspection stamp on the plane is the green light for delivery of, and payment for, the plane. Thus, quality control, in effect, accepts the plane as spare parts for the government.

The flight test and acceptance division has the responsibility of flying each production plane for functional testing the basic article and each of its systems in flight.

This is done to insure that the plane is capable of performing its mission as described by the specifications governing its flight characteristics. In addition, the division initiates the contractor's ARDC-planned experimental flight test programs, which include tests of plane characteristics as well as checks on system developments.

Contract Division

The contract division freshwater that part of the plant rep's responsibilities which pertain to contracts with the prime contractor. The division's functions include:

• **Approval of expenditure of obligated funds for facility construction.**

PRODUCTION

• **Authorization for payment of invoices for delivered products and partial payment to be made during the production period.**

• **Approval of requests by contractor for overtime in order to prevent production bottlenecks.**

• **Participation in Bq, AMC, negotiations with contractor recommendations to higher headquarters (OCAMA and AMC) for changes in existing contracts to accommodate the changes in the production program.**

• **Participation in price determinations and negotiations on completed or not awarded contracts.**

In addition to the above traditional activities, there are other support functions within the plant rep's office, such as security, traffic, operations and property administration.

There are always problems arising which require close cooperation between ARDC, AMC, the tactical commands (OCAMA and the plant rep) and the B-47 contractors (Boeing, Lockheed and Douglas).

• **Field Difficulties—Many difficulties arise with respect to operation of planes in the field, which may involve educational factors in operational procedures and, sometimes, deficiencies in equipment.**

In many cases, either type of difficulty is solved by OCAMA calling on the contractor to furnish representatives to work directly with the using agencies or in cooperation with OCAMA personnel who constantly work with this type of problem.

Contractors usually are more than willing to see that the using agency gets the best operational service from

LOCKHEED-BUILT B-47s roll along final line in company's Georgia division. Inset shows main production plant covering 47 acres.





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APPROACH CRUISE. 10% droop and (right) due to modification addition



MODIFICATION JOES done outdoors in "hangar" area west of Boeing plant



UNIT HANGARS at Douglas house B-4's for modification, cycle maintenance

an attempt to stay current in the field of progress.

All such changes are tightly governed by Rq, USAF, through ARCC and AMCC in the field.

► Does It Pay?—Following through on the retrofit job, OCAMA holds joint review discussions with the prime contractor to determine realistic views on the feasibility of the various modification items. Following this discussion, the contractor—Boeing, for example—proceeds with a cost and time proposal, which is presented to OCAMA and ARCC for final review. This review weighs urgency of modification against time and cost data.

After that, OCAMA makes recommendations to AMCC which, in turn, goes to USAF headquarters for establishment of the requirement. On approval, modification progress is initiated. The actual work might be done at

one or more of the three prime contractors—Boeing, Douglas, or Lockheed—or even at Twente AFM. If the work is done at a location other than Boeing, then the latter would supply only the technical data, and the cost and time information would come from the modifier.

Modification kits could be supplied by any of the three primes, or by a subcontractor, if OCAMA approves.

► B-47 Modifications—Some of these modifications have involved:

- Water separator to allow improved takeoff performance through thrust augmentation. Water injection could supplement or eliminate rocket motor thrust, depending upon takeoff conditions.
- Increase in takeoff gross weight, reducing structural load up and additional pilot for time.
- Installation of electronic equipment

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These subminiature relays (least size shown) are hermetically sealed, designed to meet and to some degree exceed, the requirements of MIL-R-17119. They are thoroughly designed and thoroughly tested at a pressure of one atmosphere.

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Completely and rapidly constructed, the relay is subjected by a vibration shock battery system of exactly one and seven cycles having, in addition to high shock resistance a built-in heater for shock and vibration.

The entire relay unit is made of stainless steel and is completely sealed under vacuum conditions which results in a product which is superior to one made of stamped parts.

Units of production relays, under MIL-R-17119, have proven that they exceed the requirements of MIL-R-17119 by an ample margin in every respect.

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PRODUCTION

squared for various reasons.

• Improvements concerned with defense systems, landing system, radio communications equipment, autopilot system, and accordingly to various directer companies.

The local plant ship's when it comes able for checking the work and for the flight acceptance of modification jobs, work the same as it checks production jobs and does flight test acceptance on those plants.

The contractor's personnel does its own inspection and flight tests before those jobs are performed by the plant's pilots.

• Cycle Maintenance—Keying modifications with cycle maintenance is another instance where OCAMA works closely with industry. When it is done in the field for cycle maintenance (usually about every two years) to any one of the three prime contractors or Tinker AFB, OCAMA may specify that the maintenance skill include specific modification tests to be done concurrently with the maintenance work. OCAMA would specify these concurrent modifications early within the SAC, USAF-controlled program and after consultation with SAC, other commands and the contractor. The latter would be consulted for operation on time factors and availability of parts.

• Year's Notice—Notice of this modification work to be done concurrently with cycle maintenance may be given as much as several years in advance so that plans can be made accordingly—both proposed and reasonable schedules set up.

When the program for cycle maintenance of the B-70 was in its development stages, OCAMA knew the advantage of having Boeing and other contractor personnel obtain basic information with General's SAM-SAC (Special Aircraft Maintenance/Strategic Air Command) program for modernization and cycle maintenance of the B-36.

These contractor representatives visited San Antonio and Fort Worth for this information. Boeing personnel on their own also visited other maintenance operations both on the East and West Coasts, and also visited West Coast Air Force maintenance contractors (North American Aviation and Douglas).

After these initial visits additional personnel were sent out for more specific information. Boeing feels that this information data has been very helpful. Boeing's observations have been passed on to OCAMA and is helping to develop an OCAMA program for most benefit to SAC—it has helped in the sequencing of plans for modifications and the degree of modification rates desired to build up an efficient learning curve so that SAC can get "the most



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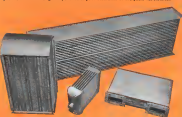


paralyzing temperatures exchanged for operating temperatures

Engine and equipment requirements in heat exchange performance become more critical with each new design. Temperature limits are less flexible. Temperature controls must be more positive.

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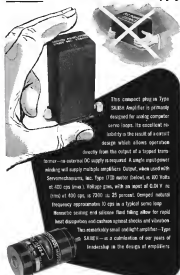
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This compact plug-in Type SA88B Amplifier is primarily designed for analog computer servo loops. Its excellent reliability is the result of a compact design which allows operation directly from the output of a tapped transformer.

—no external DC supply is required. A single input power winding will supply multiple amplifiers. Output, when used with Servomechanisms, Inc. Type 17B motor (below), is 800 Volts at 400 cps (max.). Voltage gain, with an input of 0.25 V. r.m.s. (max.) at 400 cps, is 7300: or 25 percent damped natural frequency approximates 10 cps in a typical servo loop. Resistor loading and silicone fluid filling allow for rapid heat dissipation and cushion against shocks and vibration.

This remarkably small and light amplifier—Type SA88B—is a culmination of over years of leadership in the design of amplifiers.

Servomechanisms, Inc. Type 17B motor will amplify the output of the amplifier to a desired control motor which controls a servo in the output loop of the amplifier.

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IN PRODUCTION

ment" in the shortest time.

Financing of spare parts, machine tool acquisition and facilities construction are other areas where OCAMA lends close support in a program such as that of the B-47.

►Financing of Spare Parts—Since OCAMA had not yet participated in the B-47 program, queries for the plane were provisioned by the contractor after consultation with AMC signals and maintenance representatives regarding type and quantity of items required.

These items might include everything that the Air Force might need to sustain the plane in accordance with its operational plans. Accordingly, these items could include landing gear, fuel nozzles, valves, and various bits and pieces for repair. Government furnished aircraft equipment would not be excluded.

This direct AMC contact has been allowed since OCAMA came into the picture under ANAC's distribution plan.

Now, policy guidelines and final approval rest with ANAC, but OCAMA requests recommended quantities and budget prices for spares under a new contract. A contractor such as Boeing supplies the data and OCAMA sends out the instructions to the representatives of those prime suppliers. The data to Boeing, Douglas or Lockheed then follows. The contractor either receives these three spares or provides them from a subcontractor for shipment.

This arrangement is a new development on which OCAMA and Boeing are working together. The procedure is still in the process of refinement.

►Co-Going Machine Tools—With respect to machine tools for a new (and, expected) contract of a new model of an existing plane, such as the B-47, the contractor surveys its present machine tool capacity, develops what new tools it will require, and submits an Appendix A (1) list and cost to OCAMA for transmittal to ANAC for budget plan and pricing.

Upon satisfaction of the plant contract award, the contractor submits a complete justification for the individual machine tools. This list is approved by the local contracting office in its entirety.

After the list is accepted against Air Force machine equipment surplus plant items and national pool assets and processed where possible from this source.

Those items which cannot be filled from this source are obtained by the contractor under AF authority.

On new construction, the OCAMA representative surveys, from a technical standpoint, the contractor's plans and specifications for the facilities. Approved items go through OCAMA to ANAC for



OCAMA COMMANDER, Maj. Gen. W. G. Swine, discusses job with headquarters at Lockheed's Burbank, Ca., plant, where B-47s are built under OCAMA production.

final approval and authorization for the contractor to proceed with construction of facilities.

Weapons Phasing Group

Both OCAMA and the plant are participants in the B-47 Weapons Phasing Group meeting. These are held periodically, from 30 to 60 days apart, and include representatives from the contractors (Boeing, Lockheed and Douglas), ARDC, SAC, Air Training Command, and the B-47 Production Committee.

The ANAC representative of the Weapons System Project office (AWG and ARDC) serves as chairman of the meeting.

Purpose of the Weapons Phasing Group is to present mutually problems of operations (daily flying), logistics support, training, and operation of proposed changes on a production basis and/or retrofit.

Heavy Press Program

A financing example of flexible and cooperative on the part of ANAC is the heavy press program it is directing (Aviation Week, Mar. 2, 1973, p. 98).

►Retrofit to Const—Various and various manufacturers will benefit tremendously from the longer, "more precise" parts to become available with the operation of the large presses involved in the program.

Latest experience with the Air Force \$5,000,000 large press at Wichita-Garden, Waco, Texas (which produced heavy large work in that country), and the 16,500 ton rest at Alameda Co. of America, Cleveland, as showing what benefits may be derived from the new presses scheduled for operation soon. Parts from the 18,000 ton press long have been recognized

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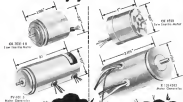


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Type	Best Voltage	Max. Power	Max. Torque	Max. Speed	Max. Acceleration	Max. Deceleration
Model	Phase 1	Phase 2	(Watts)	(RPM)	(G's)	(G's)
LOW INERTIA MOTORS						
CR 300-10	15	15	5	15000	8.15	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-10	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
STANDARD MOTORS						
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000
CR 300-1	15	15	10	15000	10	15000

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■ PRODUCTION



TAPERED SHEET for B-47, side view, top and bottom views, is a product of VNC-sponsored milling and grinding, hence way down to B-47 is 1/2 in., on B-47, it is approximately 1/2 in. (dft)

in the B-47, B-52 and other planes. Now being tested on an experimental basis are four (two Wyman-Gordon and two Alcoa) parts which will clearly show the design techniques which will ultimately be available from the larger process.

One of these developmental findings is produced with no draft. On the new developmental parts, new tolerances achieved will mean that machining will be as little as one-tenth of that previously required.

Industry observers state that "one corner" designs may be developed by the point where it will only be necessary to machine such surfaces in houses.

► **Tapered Sheet**—Another outstanding example of VNC-sponsored facilities is a large tapered sheet and plate rolling mill operated by Alcoa at Decatur, Iowa (Aeronautics Week June 25, p. 54). The rolling mill and other machinery equipment has been supplied to Alcoa under a lease arrangement with ACP.

From this mill, Alcoa supplies tapered sheet for the B-47, the smallest ranging from 1/2 in. at the wing root to 1/2 in. at the tip.

This tapered material uses large amounts of milling, machine tools, scrap, repair and assembly—until factors in a production program.

Other equipment being installed at Alcoa under lease arrangement with the Air Force includes a large rolling machine capable of machining 18x18 plates and a 7x10 taper grinder. This equipment will enable meeting production requirements for longitudinally tapered material with multiple taper and external with numerous types.

Production Committee

One of the important activities in the Stinson program is the B-47 Production Committee. Currently, the committee's present interest with respect to the B-47 program is to coordinate the production plans between



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How Best Hoist Hoist

■ PRODUCTION

for their prime contractors—Boeing, Douglas and Lockheed.

Chairman of the Production Committee is Lt. Col. R. J. Deber, who reports directly to AMGC's Office of Director of Procurement and Production, headed by Maj. Gen. D. B. Baker, who in turn reports to Gen. R. W. Kewley, Commander, AMGC. Contractor representatives are Boeing's D. C. Rowland, Lockheed's P. D. Holliswell, and Douglas' L. C. Schlegel.

► **Discussion:** *Vote-76.* The Production Committee started operations in 1951, when a formal base for the production of the B-47 was established and the three prime contractors were chosen to turn out the planes. To date there have been about 97 meetings of the committee. Some have lasted several days, some only a few hours.

Decisions of the committee are as quick as to be anonymous. This is not always as easy alternative, but usually satisfactory results stem to a matter of generalities. The committee meets at the tail of the chairman or upon request of any member.

There have been hardly any matters which were not ultimately resolved in the thousands of problems which have been discussed, although the representative contractors have started out with widely varying ideas.

In many of the specific problems, AMGC may not have a direct answer because it will get a good product in any event. But where the chairman feels that Air Force interest may be jeopardized, he will exert pressure as a member of the committee.

► **Choosing Subcontractors:** One of the big jobs which confronts the committee is concerned with recommending to the establishment of controlled subcontractors.

The committee recommends who the subcontractor shall be and assigns the technical prime contractor (one one of the three companies) to assist that subcontractor for the program. The subcontractor may supply one or more of the three companies with a component such as a wing.

► **The Visual Gauge:** A big assignment for the Production Committee was the master gauge program. Before the gauges were in existence, the committee had to determine which contractor was going to get what gauges on which date. This was a complex situation, because nine of the three primes build the plane in the same order—production planning views between the three companies.

The master gauge program is one of the keys to interchangeability and standardization. With these different companies producing the plane, there is one set of master control gauges. These gauges are actually the heart of the program because they control the master

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STOCKS AND INVENTORY



■ PRODUCTION

How AF Runs \$10.6-Billion Spares Setup

By Katherine Johnson

Air Force's area of continual improvement that never will reach perfection is the \$10.6-billion spares and spare parts program. Objective of the program can be simply stated: to order the "right" parts, in the "right" amounts, and have them in the "right" place at the "right" time.

For perspective on the complexity of the program, consider this:

USAF possesses more than 380,000 different spares and spare parts to support its aircraft. More than 470 factors enter into the evaluation of future requirements for spares.

■ Wide Variations—Some parts are bought by the million (such as standard hardware), complicating inventory control. Other parts are bought by case, truck, and drum (such as in-gal fuel), complicating development of stocks. They must be at the right places at the right times, and there are not many to spread over USAF's worldwide operations.

The program ranges from tiny location marking a location of a seat to high powered engines costing a quarter of a million dollars.

Such factors in the USAF program leaves a backlog of problems for the management of the spares and spare parts program, headed by Brig. Gen. Frederick Dine, director of supply and services, Air Materiel Command. Each mission or aircraft design means a change in parts procurement, perhaps the procurement of hundreds of parts. Each change in the operational program—the decision of a commander to fly one type plane over and another type less—means problems demanding solutions in stock on-hand and in stock on order.

Computing Requirements

■ Factors—Dine describes the computation of spares and spare parts requirements:

"It involves a multitude of people at each of our depots and at higher echelons. It involves scores of programming, information, gear and fabric, scores of assets and war data, many worksheets, extensive machine calculations. In essence, we collect the experience data on each of the 380,000 items, derive consumption factors, present this against the future program, subtract all auto-stocks on hand and on order, and arrive at a net requirement. Even with a detailed 300,000 item computer, the question of whether the logic result is too much or too little on a judgment basis remains.

"Percentages are not good measures since both war and peace deployments

turned in the past and spare parts program is its change. Both are far beyond government—its money saving through more efficient government and employment. The two more approaches are high-level control and either inventory control.

■ High Value Control—The special "spare study group," headed by industrialist H. G. King, grouped the im-

USAF'S INVESTMENT IN SPARES AND SPARE PARTS: \$10.6 BILLION

This is the fiscal picture on USAF's spares and spare parts program, showing an on-hand inventory of over \$4.6 billion and a backlog either on order or to be ordered of over \$6 billion.

	Initial Stock—on hand or in transit	Initial Stock—on order or in transit	Initial Stock—on order or in transit	Initial Stock—on order or in transit	Initial Stock—on order or in transit
Inventory July 1, 1952					9,800.4
Spares	7,942.4	231.0	2,272.7	375.6	10,821.7
Parts (35)	3,060.0	28.7	576.6		3,665.3
1951	2,420.0	15.0	437.5		3,172.5
1952	1,863.0	11.6	347.5	120.6	2,452.7
1953	1,752.0	10.0	292.7	143.6	2,198.3
1954	1,752.0	10.0	292.7	143.6	2,198.3
1955	1,752.0	10.0	292.7	143.6	2,198.3
1956	1,752.0	10.0	292.7	143.6	2,198.3
1957	1,752.0	10.0	292.7	143.6	2,198.3
1958	1,752.0	10.0	292.7	143.6	2,198.3
1959	1,752.0	10.0	292.7	143.6	2,198.3
1960	1,752.0	10.0	292.7	143.6	2,198.3
1961	1,752.0	10.0	292.7	143.6	2,198.3
1962	1,752.0	10.0	292.7	143.6	2,198.3
1963	1,752.0	10.0	292.7	143.6	2,198.3
1964	1,752.0	10.0	292.7	143.6	2,198.3
1965	1,752.0	10.0	292.7	143.6	2,198.3
1966	1,752.0	10.0	292.7	143.6	2,198.3
1967	1,752.0	10.0	292.7	143.6	2,198.3
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1971	1,752.0	10.0	292.7	143.6	2,198.3
1972	1,752.0	10.0	292.7	143.6	2,198.3
1973	1,752.0	10.0	292.7	143.6	2,198.3
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2099	1,752.0	10.0	292.7	143.6	2,198.3
2100	1,752.0	10.0	292.7	143.6	2,198.3



Aircraft Controls

On Radioplane Co.

Radio Controlled Aerial Targets
for gunnery practice

Type OQ 19 Radio Controlled Aerial Targets—sometimes called BGCES—use the standard inputs used in gunnery training of anti-aircraft and airborne gunnery crews of the Armed Forces. Product of Radioplane Co., a subsidiary of Northrup, these drones are maneuvered from the ground to simulate enemy attacks. Barber Colman Micropositioners, ultra sensitive potentiometer relays, constitute the output stage of the autopilot on the BGCES and position the control surface actuators through intermediate relays. Used for hundreds of applications, these relays are available in a wide range of sensitivities, coil voltages, and mounting details. When you, too, have need for controls designed to the particular requirements of your application, consult Barber Colman Company.



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HIGH-VALUE CONTROL

Two and three-fourths percent of the number of aircraft spaces accounted for 61.8% of the dollar investment. These are the items USAF is closely monitoring in its efforts to economize.

Aircraft	Total Number of Spaces	Number of High-Value Items	Percent of High-Value Items	Total Investment in Spaces (in millions of dollars)	Investment in High-Value Items (in millions of dollars)	Percent of Controlled Investment
B-47	4,102	163	3.9%	\$271.5	\$149.3	55%
B-52	8,900	153	4.4	\$10.3	\$91.4	84
B-57	3,922	165	3.7	\$4.5	\$3.4	79
FB-56	3,668	125	3.4	\$1.3	\$8.8	69
C-47	5,918	134	2.1	\$9.8	\$6.4	65
C-119	2,400	170	3.3	\$1.3	\$1.6	34
C-119	3,000	141	4.7	\$8.2	\$19.8	58
C-124	8,000	300	3.7	\$6.2	\$1.3	21
F-84	2,616	57	2.1	\$15.4	\$6.9	45
F-86	3,800	109	2.8	\$11.3	\$4.5	40
F-99	5,050	91	1.8	\$4.9	\$4.3	87
F-100	4,250	92	2.2	\$15.9	\$4.6	29
F-101	3,218	141	4.4	\$4.6	\$1.5	33
F-105	2,600	75	2.9	\$1.3	\$1.3	100
T-28	2,600	100	3.8	\$16.6	\$1.0	6
T-33	2,400	92	3.8	\$6.6	\$1.5	23
TOTAL	12,001	1,183	9.8%	\$1,229.6	\$199.7	16.3%

probability of existing procurement and existing control over 61 of the 500,000 items in the program. Until then, comparable controls had been used on all items in the inventory.

The group's first study developed that a small "sample" of items comprise the major part of the total dollar investment. It showed that 2.9% of the number of different types and space parts for airplanes accounted for 61.8% of the total investment. By focusing attention on this small number of parts, the bulk of the money could be better controlled. Measures to increase procurement, expedite distribution, reduce repair cycles and reduce "on spec" purchases, and tighten up inventory control on these high-value items were suggested.

► **550 Million Reduction**—By investigating, analyzing, and the total implementation of all high-value control programs for airplane spaces and space parts, USAF reports, resulted in a net reduction of \$550 million. Implementation is a continuing process. Experience factors and the expedient reporting of them and reflection of them in the program continue to perfect control.

USAF emphasizes that its target was not to reduce the number of items in the program but to reduce the cost of the items. The program is not to be reduced in cost but to be reduced in cost. The program is not to be reduced in cost but to be reduced in cost. The program is not to be reduced in cost but to be reduced in cost.

Radio controls also have been applied to the highest-value single item in the program, space engines. Re-engineering, by several methods, of the time between overhaul before, alone, USAF reports, have reduced expenditures by hundreds of millions of dollars.

USAF now is drawing up selective lists of the high-value spaces and space parts involved in the engine program, the electronic, guided missile, and aircraft program. The results are not expected to be as dramatic as in the aircraft space study since reductions have already been accomplished to a great degree. Space parts in some of these items tend to approximate each other in cost and in the total weight used involved. In the aircraft space study, the difference between the low high-cost items and the low-cost items in space parts was significant. In the aircraft space study, the difference between the low high-cost items and the low-cost items in space parts was significant.

Previously the program was under "item" control. One million bearings, costing three-fourths of the cost of each engine, are in each engine as "1000-825." Two 3-1/2 in. by 10 in. bearings, costing \$10,000 each, would cost \$10,000.

Under the dollar inventory system, the bearing stock will show up as \$5,000, the 10 in. by 10 in. stock will

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linear or curved potentiometers
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circuit.

... its snap-and-go action eliminates the noise it imparts in "open" the switch (left or right contact).

... its light-actuated contact makes it known the released spring (ball-beam) mechanism has yielded, carry higher voltage systems of the same variety (top right).

... the "push" and the "pull" make it work in both directions. "Push" (left) and "pull" (right) are shown with the ball-beam snap-action mechanism.

... its light, sturdy, and motion-impeded design, ball-beam snap-action switches and terminals at open with heavy duty, developed designed for a minimum life of 10,000 cycles under load.

Today more and more engineers and equipment manufacturers recognize that equipment dependability, space saving, Hetherington switches is really the "right" application. Based on the fact of application for a precision snap-action switch, Hetherington switch specialists.

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■ PRODUCTION

show up at \$507,600. Total savings must will be able to concentrate on the area of big money investment in effects to control inventory.

■ **Endurance Apparatus**—A light over stocking of less-than-stock items, money-wise, means little. But a slight overstocking of \$20,000 items might add up to millions of dollars. Areas of redistribution (as restricted at one base and ready at another) that do not show up on the items necessary will be desirable under the dollar inventory.

When the Air Force knows the items in which its money is invested, it will be in a relative position to control inventory.

Since the outbreak of the Korean war in mid-1950, 510 billion has been appropriated for the space and space parts program. This compares with \$15.4 billion for complete aircraft plus additional funds for modifications. Actually, out of every dollar for the two government programs, 70 cents has been for complete aircraft and about 30 cents, including spare parts, for the two government programs. And, there is support modifications for space and space parts to support the aircraft.

It should be noted that a large part of the 510 billion has been required to support other overall programs in very low prior to the \$15.4 billion appropriated for new aircraft.

Kilgore is the space and space parts program.

Reg. Gen. Fendrick, DOD is director of supply and services. An engineer and intelligence officer since 1946, he has been the Military Secretary in 1952. DOD coordinated the supply efforts for the two armies of World War II—the English Channel and the Mediterranean. From data on aircraft he is provided from the Deputy Chief of Staff for Material and from data on USAF's operational program presented in AMC headquarters and in the national defense system under DOD's direction, compare the space and space parts requirement and program the development to design and build.

IL O'Keeffe is chairman of the "space study group" established in 1952 to tackle the problem of keeping some of the cost savings elements into the program. O'Keeffe's career was high-value control. During World War II he headed War Production Board's copper division and later was chairman of the combined steel-copper committee. O'Keeffe is board chairman of Materials Line, and a director of numerous firms, including Raytheon, Inc., Texas Gulf Producing Co., and Southern American Bank and Trust Co.

Spares Program

USAF's space and space parts pro-



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Standardized equipment is now available for complete systems for multi-channel data transmission over a single radio link or recording on a single magnetic tape track, using time-division multiplexing and pulse width coding. ASCOP systems engineers can now choose from a complete line of units for sampling, coding, transmitting, receiving, monitoring, sequencing, editing, and recording to assemble systems to meet your data transmission or recording problems.

Pulse width data systems provide, through time division multiplexing, a large number of channels of data rates of moderate frequency response. The handling of information in the form of time rather than amplitude allows accurate operation independent of the characteristics of the transmitting or receiving medium. Unknown of new and constantly improving channels with continuous automatic system calibration and avoids the need for frequent manual adjustment.

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■ PRODUCTION

parts will be needed? Should it be added as a spare part? Should it be included in spare stocks, and in what quantity?

► **Modification Spares**—Spares and spare parts under this sub-program are manufactured by repair changes in aircraft, mostly made at the contractor's factory, each as changes, due to improvement to a new service, changes in configuration, systems of military characteristics.

Changes in aircraft design, to perfection or retrograde, make out of the headstock of the management of the spares and spare parts program. What spares and parts do the design make obsolete?

One of the primary areas USAF is concentrating on in perfecting parts procurement and utilization is "interchangeability." Can a spare or part made obsolete, because of a design change or for other reasons, or not simply be utilized on another aircraft? To answer this question requires detailed and comprehensive inventory and characteristic data.

USAF expects to allocate about \$160 million under this sub-program in fiscal 1953. Of this amount, \$37 million is in carryover funds and \$123 million in new money.

► **Follow-on Spares**—This sub-program is geared to the follow-on program. Other factors, though, enter into the computation of requirements: consumption of the initial twelve months' supply, repair cycle and other pipeline factors, and number of airplanes, such as in-service requirements. For example, fluctuations in the repair cycle factor, the determination of test stocks are out of service, inaccurate reflect in the requirement. The increasing worldwide deployment of USAF squadrons is increasing the repair cycle and other pipeline problems.

On certain precision items, high-cost or rapidly needed items, USAF uses air transportation to cut down the out-of-service time. But USAF is reluctant to become reliant on airfreight, which would be required for fuel transport and other high-priority missions in an emergency.

Two comments.
"Air transportation would certainly reduce in transit time whenever applied and, with speeded-up delivery, would warrant reduction of stocks on hand in many instances. This in turn would mean reduced warehousing. However, use and change can be accomplished without aerial delivery, both in peace and in war."

► **Expanded Local Production**—In an attempt to cut down the warehousing bill for its inventory spares and spare parts inventory, USAF is expanding the local-production concept and expanding closer contractor ties relationships.

The other reason the follow-on spares

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Flex-Head Wrenches—
fastest, most versatile wrenches on a wide, wide range of jobs!

Each socket of a Snap-on Flex-Head gives through an arc of over 180°. The wrench swings readily over or under an obstruction—easily handles hard-to-get at nuts, studs, bolts. A friction spring holds the socket at any desired angle, and the chamfered edges of the openings aid in quick placement on the work. With the handle held in a vertical position the user can be spun rapidly. Flexing the handle over provides maximum leverage for tightening or breaking loose.

Snap-on Flex-Head wrenches are widely used for assembly and maintenance operations... real time savers for such service as locking and unlatching milling machine pins and tightening flange bolts. The one illustrated provides all wrench sizes from 1/2" to 1 1/2", with the most widely used sizes duplicated in different handles. Available through Snap-on factory branch warehouses in principal industrial centers. For special industrial catalog and General catalog of 4,000 Snap-on hand and bench tools, write

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There's an important story for you behind this solenoid.

Its development called for an entirely new approach to original design, and the engineering of Sargent never before built, was precision project solenoids. PSP and customer engineers—working together with new tools and new methods—came up with this new path from start to finish.

- Coordinated ambient temperatures to 200° F
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- Has a precision built solenoid plunger stroke
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- Is built precisely on the plunger stroke
- Operates on 30 Volts D.C.

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IN PRODUCTION

and spare parts sub program costs sub starting less than the total spare program is that it does not include spare engine procurement and many other items not normally considered in spare parts. Since the Korean outbreak, \$2.3 billion has been appropriated for the follow-on program, charged with \$7.9 billion for the initial spare program, of which \$2.8 billion is for complete in place.

This year, the follow-on program is being increased from \$250 million in fiscal 1954 to \$400 million. This is because operational flying was less last year under the 170-meg program, a greater portion of the aircraft to be supported are of modern more expensive models and the need for saving Air Force levels of strategic reserves.

Procurement of maintenance spares for individual aircraft illustrates the cycle in the follow-on program.

■ B-57. Maintenance parts will jump from \$596,000 in fiscal 1954 to \$4.4 million in fiscal 1955. Largest percentage of the jump started a year ago, and fiscal 1954 operations previously were supported with aerial spares. The maintenance problems of the first year's support stock will be eliminated for an increasing number of B-57s over the coming year.

■ B-36. Maintenance parts will jump from \$7.3 million in fiscal 1954 to \$21 million in fiscal 1955. Initial spare procurement supported 75% of the B-36 fleet in fiscal 1954. But production has tapered off and the percentage of the fleet that will be supported from the initial spare program in fiscal 1955 is down to 75%.

■ B-29. Maintenance parts will also jump \$4.7 million in fiscal 1954 to \$3 million in fiscal 1955. The plane is being phased out.

■ Convairite. Spares—This sub program supports the initial spares and spare parts required because of "convairite" modification of in-service planes. It is usually a comparatively minor modification made at the base level to improve certain characteristics or to correct deficiencies or deficiencies in the modified equipment. The need for corrective maintenance declines with the life of the aircraft.

Funds for this corrective maintenance program have remained fairly stable \$110 million in fiscal 1955, \$123 million in fiscal 1954 and \$125 million for fiscal 1955. Of course, into a minor portion of these dollars are credited for additional spares to support the corrective maintenance.

Inventory & Consumption

A striking feature of the spare and parts program is the comparison of



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"Good will" is the direction of the placed orders
to come to the place where he has been well treated
—U.S. Supreme Court

Where's "Charlie"?

The "bird" will find him!

As it zips along at supersonic speeds—high above the earth—its guidance system directs it accurately to target "Charlie."

Electronic warfare today's accurate missile guidance is reality—and electronics in the past, present and future of RCA.

For years, RCA has been working with the Armed Forces on design and

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GOVERNMENT DEPARTMENT
RCA
 RADIO CORPORATION OF AMERICA
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 CAMDEN, N.J.

■ PRODUCTION

secretaries with disintegrators.

USAF now has on hand an on order almost 50 billion in stock, and plans to order over 51.7 billion more this year. Concomitant with the Korean outbreak, over four years ago, has been less than \$2 billion.

This raises one of the unasked congressional questions: Why not work down the inventory—use it up or dispose of it?

Contingencies—showing worn-out items that must be replaced—a safe net of five contingencies in existing requirements. Of USAF's \$10.6 billion investment in spares and spare parts, slightly less than 20% is allocated for contingencies.

The last offer immediately met.
 • **Readiness reserve.** This is the backlog required to support the regular Air Force and reserve components that would be put immediately into action from the outbreak of a war to a planned time thereafter when expanded production could meet combat needs.

AF likes a reserve sufficient to the needs of a major conflict and that time to make limited non-combatable items, however, has this level been achieved. The readiness reserve accounts for approximately 10% of the investment in spares and spare parts.

• **Stock supply.** This is the forward-half-monthly stock level required to assure against the preceding all phases for lack of spares or spare parts. It provides for replacement of items drawn out of service, in pipelines either for repairs, new deliveries, or other reasons and is divided among depots in the U.S. and overseas and the shipping lanes. The pipeline requirements—the stock, required to assure our uninterrupted flow of replaceable items to the user to replace damaged or worn items assure to and being worked on in the maintenance shops—at all forward-half-monthly for the continental U.S. and at seven months for overseas. Stock requirements approximately 20% of the investment in spares and spare parts.

• **Engineers.** Because of this high cost, spare engines are managed separately. The program requires approximately 38% or 53 billion of the total investment in spares and spare parts that is never "consumed." It shows up in inventory, and disposed of. Spare engines are computed on the basis of time and one-half months pipeline in the U.S. and seven months overseas to support the overseas cycle. Some spare engines are included in the readiness reserve and the stock supply.

• **Contingency spares.** These are spare plane spares for which there is no type information to make a permanent decision for use, stock, or reserve. It becomes a management judgment as to what would be required for some emergency. The requirements approximately

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Eight gold-plated pins are precisely pointed. These are designed for interconnection rather than for screw leads. Each is built-in, self-aligning and has a precision point lead, resulting in true levels or low misalignment may be used at higher sensitive settings. Standard current carrying capacity of each slip ring contact is 0.5 amperes continuous duty, with maximum resistance 5 ohms. Connections of power and instrumentation leads can be supplied.



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6. DEEP CHASE BOLT—1/2" deep, provides more CHASSIS depth mounting holes

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This is the only one!

This Fiberglass carrying case has been designed by the United States Air Force and the Bureau of Aeronautics United States Navy for heavy duty storage and shipping of aerial cameras and other precision instruments—without any exterior riveting or protrusion of any kind.

It is manufactured by Koch of California—specification MIL-C-41548(USAF). First paragraph of the specification reads as follows:

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1.1 This specification covers rigid heavy duty storage and shipping cases capable of providing Method 11D packing in accordance with Specification MIL-P-116 with no additional packaging of the case.

More than 40,000 of these cases are now in use by the Air Force and Naval Bureau of Aeronautics all over the world. To date there has not been a single country or a case of the valuable equipment contained.

This case has been dropped by parachute from a plane flying 150 miles an hour at 600 feet altitude (equivalent to a free fall of 25 feet), without damaging case or contents. It has been submerged in 40 feet of water without leaking. It will not dent or puncture. It is fireproof and mildew proof. Vapor and moisture transmission rate is zero.

This case, or variations thereof, is now available to manufacturers of military or civilian products that need maximum protection in handling, storage or shipping.

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■ PRODUCTION

Gearing Industry For M-Day

To meet the threat of another war Air Materiel Command and its big partner, the aircraft industry, must have production capacity standing on the shelf.

There must be drilled components, tools, raw materials, and factories, all geared for swift integration. When M-Day comes, we need much more, not just in a matter of weeks, not the four years that were required in World War II.

Col Vincent T. Canine, new Deputy Director/Maintenance Planning at the Directorate of Aircraft and Production, drops these major aircraft industry collaboration problems:

- Are the individual companies prepared for wartime expansion, so that complex modern air weapons will not off the production lines with maximum delay?
- Are the aircraft companies taking adequate defense measures? This includes plant dispersal away from target areas, use of protective construction and fire-bombing of secondary areas to spend technical know-how around the country. In case of attack, swift relocation is vital if a facility is all or partially destroyed.
- How can the aircraft industry maximize existing capacity in the face of production cutbacks? America has a lot of assembly lines, with the concomitant dollars to keep them running at more than normal capacity. When industry loses money keeping the wheels turning, it could make more money if they turned from more than 5¢ a shift in a day, there is a strong incentive to close.

Plant Reserve List

USAF today has 307 facilities on its Industrial Plant Reserve List. Assigned during and since World War II, most of them are in active production.

- 41 are owned by USAF and occupied by major weapons critics. Production examples are the Ford plant in Chicago, Lockheed Martin and Convair PL Works.
- 72 are National Industrial Reserve plants.
- 12 are privately owned plants housing major portions of equipment that belongs to USAF. These include major engine plants such as Packard in Union, Mich., and Hamilton in South Bend, Ind. Equipment includes test cells, and spare, tool loans, obsolete elements, etc.

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Not long ago 550 mph was the record. Today it's 754.98 mph—but that's only the beginning! Next week or next month, some time soon, it will be broken as jets fly faster and faster. At speeds like these, "perfect" performance is demanded of every part. To meet these highly critical standards, leading aircraft manufacturers "look to Lavelle" for the finest in stainless steel and aluminum aerospace and composite parts.



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■ PRODUCTION

down or get rid of industry between those frequently is more profitable than pure.

Techniques and Skills—Chief AMC officer in charge of these problems was May C. Koss D. Metzger, head of the Industrial Resources Division. In the general aviation, techniques and skills are fully as important in achieving the mobilization goal as the availability of new tools and material in aircraft plants.

In addition to creating a reserve of production resources, Metzger said, "The highest degree of response ability and productivity" must be built into present facilities of the aircraft industry.

Among the possibilities presented under Metzger's report and recommendations to the industry are:

- The heavy press program AMC sponsors the construction of large hydraulic forging and extrusion presses to speed output and improve the quality of aircraft parts.

- Application of new materials, such as titanium and plastics, whose parts are lighter, quality or ease of fabrication can be worked.

- Automatic operation of machine tools and general improvement in cutting speed and tolerances. In automatic production techniques, a machine tool is guided by a punched tape instead of a machinist. This has advanced to the point where AMC feels it warrants application to both present and improved machine tools, particularly spin and turn machines.

Further cutting speeds and improved tolerances are needed to overcome a production handicap imposed by the tough tools and great precision demanded in jet engine construction.

Before the aircraft industry can understand fully why AMC puts money to expedite completion of things like the heavy press program and automatic production, it must look upon mobilization planning as one of the missions of AMC. The objectives of this mission are, in the long run, down to help industry meet its responsibilities.

Preparation—Mission—The major mission is to develop and the aircraft industry's role as a major supplier of both talent and hardware, will cut together at the time of America's greatest need and of the nation and its objectives are achieved. The objectives are:

- To make sure that the aircraft industry can do the job in case of emergency. This applies to all levels of production—the weapons system contractor and his subcontractors, the composite contractor and the people who make GPM.
- To see if possible how when M-Day comes. The goal is to have planning, scheduling and learning complete. It applies to nations that are current in

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THE NIGHT BEFORE THE PROXY FIGHT

Harrison Wells settled himself in the comfortable seat of the company's newly-overhauled plane — his company's plane, in other words, this company, too, for that matter. He had built it, at the first, by single-handed efforts. Now, he was flying home to do battle for its control.

This year, a new group of stockholders was challenging him. The show-down was set for tomorrow — 10 A.M. in the company's board room. Harrison Wells patted the clock side of his brief case. He thought of the rest week of peace he had rounded up in a haven, cross-country tour of some 5,000 miles.

Make him the chairman of the board — kick him upstairs? Not this year! The plane flew steadily onward.



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Flights of this kind can be quickly planned and safely completed if engines are routinely rebuilt by Airwork. The personalized service and the engine exchange program offered by this national organization make possible far-top-quality performance for the privately-owned plane. Nowhere else, except in the shops of large, scheduled air lines, will you find work procedures and techniques, equal to those of the original manufacturer.

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• PRODUCTION •

every aircraft and component manufacturer's business — maintenance, design, production engineering, tools, hardware, subcontracting and second source control systems.

• To reduce the amount of damage, as far as possible, that is caused by the aircraft industry. Plans and programs must be laid out to cut vulnerability and restore its much production as possible and as soon as possible after an attack.

• To keep America's strategic planning agencies fully informed about what the aircraft industry can do in case of war, how well it can do the work passed down from the National Security Council and the Joint Chiefs of Staff to USAF and AMC.

• To make sure that the Air Force will get the weapons it is ordering on and there is no conflict with demands from the Army and Navy.

• To provide facilities support for the current program. Here is where plans to mobilize an aircraft plant at the outbreak of a war tie in with present requirements. A manufacturer of aircraft gear who is preoccupied to devote all his capacity to television sets is not in a good position for swift conversion to military output.

• So Program—Aircraft manufacturers approached to help AMC meet these objectives and perform its mobilization mission, will make their contact under one or more of six programs.

• Production Reserve Policy and Mobilization Production Base Program. Here is where AMC acts to keep tools and factories ready to join the MEDEVAC effort. The ones that are producing will have to speed output immediately. Idle tools and plants will go into production swiftly.

Obviously, this is the point where AMC's mobilization plans can lead on into successful distribution of production programs. During the Korean buildup the problem was one of getting up bricks and mortar and filling the plants with machine tools. Now in 1974, the big job is to let industry read and rebuild production rates and keep the machines in condition.

From the viewpoint of both the aircraft or component manufacturer and AMC, the best possible situation would be to keep every machine in place and even plan just to start operations the minute the whistle blows. Costs, however, are prohibitive and Air Force Secretary Tamm says no such situation exists. There are about 100,000 aircraft in the nation's state of preparedness.

Aircraft can't afford to house the aircraft industry and supply it with tools unless something falls out of the hangar door or off the assembly line.

For this reason AMC, under the Production Reserve Policy, has its choice of four things it can do with USAF

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COLD HEADED BOLTS
AND NUTS
3/32" to 1 1/2" Dia.
EL SEGUNDO,
CALIFORNIA

■ PRODUCTION

nearby tools and equipment to production rates are cut back.

- It can leave them where they are, in place on the factory floor.
- It can use "on site" storage for items removed from the production line, but left in the plant.
- It can assist them to a warehouse adjacent to the factory.
- It can move them to a central government storage site.

Depositors of a particular plant's equipment depends on how important those tools will be to M'Day. Briles, is dictated by preparatory requirements inspired by cost.

• **Preparation Contracting Program** Under some circumstances, AMC will give an aircraft or component supplier a contract to pay, line for his work in preparation for M'Day. In the past seven years about 250 preparatory contracts have been made with a total value amounting to approximately \$35 million.

Preparatory contracts provide three things for AMC:

- "Capability demonstration" in key industries. These are production plants, each one setting an objective of a given number of units. The incentive is one plane with details of plant layout, manpower needs and a breakdown on sub-contracting.

- Reliance of many projects so that they can be produced in higher volume.

- An accurate census of the resources that will be needed by an aircraft or component manufacturer to meet a customer production schedule.

- An accurate record of license agreements between prime and secondary sources on critical items. How AMC and its clients can be left without the latest information on the product and the way it is made.

Licensing is particularly important in maintaining production capacity for engines of secondary sources. For example, fasteners are provided for Pratt & Whitney at Ford and Nash. At the Nash plant, production is picking out on the RJ450 engine and the machine tools are being geared in change, manufactured for M'Day action to Nash.

Meanwhile, the Nash plant will continue to hold its license to make the RJ450 and the technical assistance agreement will be continued, though possibly Nash will continue to receive up-to-date engineering data and stay abreast of P&W methods. Ford is shifting to the J57 and increasing its production.

- Assurance that secondary or alternate sources will not be without technical data and specifications even in the absence of a license agreement. This is achieved by having duplicate information



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SPEAKING OF PROGRESS



LIVER Aviation's contribution to the progress of aircraft construction is a matter of record.

Within seven months this large, modern, and diverse manufacturing plant was completely staffed and equipped. At the same time production planning, tool fabrication and final assembly of a major aircraft component were achieved.

As sole builder of the main fuselage assembly for the B-57 Stratojet, Liver accepted a tremendous responsibility. In meeting this responsibility Liver:

- developed the ability to produce on schedule.
- achieved and maintained a high standard of product quality.
- established an enviable cost reduction record.
- and at the same time insured two National Safety Council awards for plant safety.

To achieve this goal it was necessary to develop an organization consisting of progressive personnel and specialized equipment. A few of the facilities available for aircraft construction are shown here.

The production "breakdown" developed by Liver Aviation is available to solve your production problems.

THE LIVER CORPORATION
AVIATION DIVISION
112 AIRCRAFT DRIVE
BATTLE CREEK, MICHIGAN

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1"	1114	10004
1 1/4"	1116	10006
1 1/2"	1118	10008
1 3/4"	1120	10010
2"	1122	10012
2 1/2"	1124	10014
3"	1126	10016
3 1/2"	1128	10018
4"	1130	10020
4 1/2"	1132	10022
5"	1134	10024
5 1/2"	1136	10026
6"	1138	10028
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7"	1142	10032
7 1/2"	1144	10034
8"	1146	10036
8 1/2"	1148	10038
9"	1150	10040
9 1/2"	1152	10042
10"	1154	10044
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11"	1158	10048
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168"	1786	10676
168 1/2"	1788	10678
169"	1790	10680
169 1/2"	1792	10682
170"	1794	10684
170 1/2"	1796	10686
171"	1798	10688
171 1/2"	1800	10690
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174"	1810	10700
174 1/2"	1812	10702
175"	1814	10704
175 1/2"	1816	107

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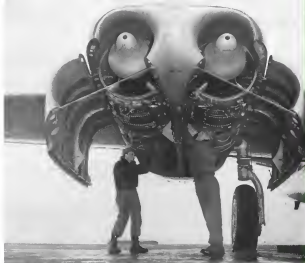
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CLEVELAND 1, OHIO



TWO OUT OF THOUSANDS, these mechanics undertake the task of maintenance on the United States Air Force.

MAINTENANCE

Making New Airplanes Out of Old

A billion dollars a year makes new airplanes out of old ones. It keeps the material of the United States Air Force reliable, operational and modernized.

Thousands of people work in maintenance. They do a myriad of jobs, from replacing a broken safety wire to rebuilding and modernizing a glider bomber.

These jobs may be done in the desert or in the Arctic by a mechanic with a kit of hand tools. They may be done on a sprawling factory floor dotted with machinery and scarred with conveyor tracks. But always these jobs are done; they have to be, because planes on the ground can't win a war.

The skill of the pilot is useless unless it is backed up by the skill of the riveter and the welder. Strategic planning at Headquarters, USAF, comes to nothing if production control of maintenance breaks down. The file clerk, the painter and the floor cleaner are all part of the long line that starts with inanimate metal and ends as a winged sculpture.

The jobs they do in maintenance are unglorious routines, sometime extraordinary, sometimes unglorious. But always they are done, because they are important jobs.

Other people design airplanes, others build them and still others fly them.

But maintenance keeps them flying.

Keeping Them Flying Is Big Business

By David A. Anderson

Maintenance is big business in the United States Air Force. In some numbers, it takes a billion dollars each year to keep the material of the Air Force reliable, operational and modernized.

About 66,000 persons work in the 12 decentralized facilities of the Air Material Command's Directorate of Maintenance Engineering, doing the myriad of jobs from better lay replacement to the complete rebuilding of a complex turboprop.

Permeating up from the solid base of the Air Material Area (AMA) and the operational depth is an infrastructure of management, operational and working policies and goals that make the office space in the AMC headquarters buildings at Wright-Patterson AFB.

On these managers and their own support in the 12 directorates rest the responsibilities of a billion-dollar business which is spending to save money, but not to show a profit. There are the men who must plan and schedule so that the Directorate can truly provide "More Air Force per Dollar."

■ **Job Definition**—The function of the Directorate of Maintenance Engineering is to keep USAF material in a continuous state of operational readiness and dependability to support USAF objectives.

But the Directorate has added responsibilities:

- Evaluation and programming of effective maintenance engineering for the Air Force
- Coordination on design specifications with ADSC to see that city maintenance is built into new designs without compromise of performance
- Provision of technical assistance to the entire Air Force and to the forces of the NATO countries

- Determination of the maintenance stage—a collaboration with the major commands—is to be performed at organizational, field and depot levels

- Accomplishment of maintenance requirements that exceed the capabilities of using organizations

- Main Functions—There are three main functions performed in USAF maintenance:

- Periodic inspection to check equipment reliability
- Repair and overhaul to keep equipment operational
- Modification to correct deficiencies or to change capabilities

This kind of work could be done in the old days by ground crews with minimum facilities and equipment. It is now easy to improve. The stores of men are filled with talents, paid to maintain the maintenance aircraft to jangle and dangle, using hand tools and handily built fixtures.

But complexity in design and performance demands the consolidation of all maintenance. The tools get specialized, the facilities get larger, the workers need more skills. The engine that cost \$30,000 at the beginning of World War II was perfectly adequate for smaller aircraft engines. Today, its counterpart for large jet engines costs 10 times as much.

Maintenance is big business. So the Directorate has been studying and analyzing wherever possible the methods of scientific management and planning that have been adopted by industry. These powerful new management tools are already pointing the way toward more economical maintenance and more effective use of the facilities and labor force at hand.

Work Measurement

Behind any work program is sched-

uling and planning, the wheels of an industry begin to turn long before any products start coming out. The first step is likely to be a letter message could hope for a clear programed workload. With that knowledge, he can ask for money, materials and manpower and be sure of getting very close to his actual requirements.

■ **Workload Forecasts**—What we'd like to be able to do is to estimate our workload about one or two years ahead," says Mr. Geo. Carl A. Borelli, who heads the Directorate. "We'd like to be able to build up data like the automobile that into normal for repair, when you can just look in a book and get a reasonable time estimate to do a job."

This kind of workload estimation is never an easy task, and is maintenance it is even harder for the basic units. Problems and job variations are inherent.

Through the larger down past fighters, transports, helicopters, trainers, trainers with piston engines or jet engines, and with as robust conventional engine equipment and related mechanisms. As aircraft are used a single overhaul or it may be a total cost and need complete rebuilding.

■ **Study Planned**—In the face of conflicting arguments as to whether or not it was possible to establish work-measurement standards for maintenance, AMEC reported the Management Services Division of Ernst & Ernst, Cleveland firm of certified public accountants, to study the situation and come up with standards that would be acceptable. Ernst & Ernst set up its operations out of the firm's New York office and began the pilot case study.

Last April the one-year contract was completed. Surprisingly Air Material Area (SMA) had been chosen as the primary job, and work standards had been determined and applied there.

Overall work efficiency at SMA was about 34% in August 1955, by December the figure had been brought up to 65%.

There is a dollar yardstick to assess the value of these percentage increases. At SMA, one percent improvement is about \$350,000 per year saved.

■ **What Is a Standard?**—The work standard has been defined in this way: Time required by an average worker to do a job while working at a normal pace under actual conditions, which exist when the standard is applied.

Once determined, the standards must be approved as attainable by the supervisor of the department concerned. It might also be pointed out that one expects a worker to produce many units of the day, the standards are adjusted to allow for



FLIGHT CHECK of F-16 is last step in McClellan AFB maintenance before shipping.



MINOR REPAIRS are done by mechanics in base and transient sections, General AFB



F-4E LINE at McClellan AFB. Cold, we received from B-29 overhaul during last year.



B-27S IN FLAM are in the first stages of major overhaul line at Tinker AFB, OK.



OVER THE SIDE cranes a stripped F-84 for overhaul at Brookley AFB, Mobile, Ala.



PLASTIC OVERCOAT covers Republic F-84 for corrosion protection during shipyard stay.



FORWARD FUSELAGES on the line at Brookley AFB are shipped for major overhaul.



AFT FUSELAGES of Republic F-84s get the major overhaul treatment at Brookley.



THERE IN TWO DAYS is rate at which these Thunderbolts come off the certified line.

system time, fatigue and invariable delays.

These standard hours are then multiplied by the planned cost output of the work center to arrive at a standard hours figure, or the so-called "earned hours." Weekly or bi-weekly repeating compares the earned hours with the actual period hours logged in the work center.

The ratio of earned hours to total hours then measures the efficiency of the work center.

► **No Speedups**—It is important to understand that these are not "speed-ups." The figures mean that the worker's effectiveness is being increased, while he continues to operate at his usual pace (assuming he's an average worker).

The difference is brought about through improved shop layout, better tools and fixtures along with better management.

There is an improvement in production control with work assignment standards. The scheduling of work is laid out of the shop can be better planned because the variations known when men are needed, when sections are overworked.

The fraction of cost distribution and cost control is simplified because:

► Material standards are also set for each job in production method.

► Industrial engineering knows how much labor will be required.

► Accounting can also overhead proportionately to each job.

► Examples: Specifically here are a pair of accomplishments at SMANMA to illustrate the value of the work-measurement program:

► **R4960 major overhaul**: From January to June 1954, men hours per engine were reduced from 1,078 to 780 and the number of personnel assigned cut from 5,840 to 941. Earned hours increased from 57,411 to 62,830, an increase corresponding to the work of 57 units processed under the old system. As a result, less men did more work and the 57 workers no longer required



NEW HEADQUARTERS for LONG RANGE FLIGHT

Here beside the long runways of Baltimore's Fennel Ship Airport is the brand new Flight Refueling plant, designed and constructed by Flight Refueling, Inc. for the development and installation of Probe and Dragon refueling systems for the Armed Services.

New in full operation, the new Flight Refueling facility is turning out an increasing number of Probe and Dragon refueling equipment which made possible the first non stop transatlantic jet flight, the first refueled combat operations and the first jet to jet aerial refueling.

And from the Flight Refueling laboratories new systems of higher capacity and efficiency are being developed.

Aviation can take satisfaction that this new plant—devoted to long range flight—is now in full operation.

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(Used with 1/2 inch Coil)



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Auburn Connectors
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Teflon Connectors

with Integral
valve springs



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1099-TV (1/2")

Connectors with stainless steel and alloy springs



1041-C (Stainless)
1041-B (Aluminum)
1041-D (Aluminum)
(AUN 4164-2)

1099-C (Stainless)
1099-B (Aluminum)
1099-D (Aluminum)
(AUN 4164-3)

1041

1099

AUBURN SPARK PLUG
Co. Inc., Auburn, N.Y.

MAINTENANCE



OUTDOORS CHECK of F-44 forward fuselage; one of last steps in overhaul



FLAME DIVIDES, mechanism made on jet jet in F-44 engine

in the action were transferred to the aircraft shop where the labor force was fully notified.

Wing-tank repairs. The actual average of hours required at all the AMCs was 15, but SNAAMA showed up with a 200-hr figure. Study of the operation produced a standard of only eight and one-half hours, which extended the supervising he thought he'd been doing well to keep five hours under the standard. But they gave it a try, and soon began to hit close to 100% efficiency.

A check of the job showed that the supervisor had made improvements in the standard of operations, and in the job was extended and a new standard of 4.5 hours was set. At last report, the team was up to more than 70% effectiveness on this new, lower figure.

This example illustrates the two phases of work improvement. First, the job of tank repair was improved by setting a new standard for the job,

using the methods traditionally applied to the job. Second, the standard was improved so that the standard could be further lowered.

The work is now being carried on by the Industrial Engineering division at SNAAMA and is expected to be fully operative throughout AMC in about two years. Standard studies will continue, become more strict and rigorous will be coming along.

Meanwhile, the segment contract with Ford & Ford has been amended to include studies in the fields of production control and in cost accounting and payroll distribution systems. These will, when successful, be fed into the rest of AMC.

Actual Methods

One of the more fascinating studies in the "Experiments in low cost engines" by Kearney when this happens, highly planning becomes easy.

Like a horse being, an engine is

LOW CORNING Silicone News

August, 1954

PUBLISHED BY DOW CORNING CORPORATION, MIDLAND, MICHIGAN

New Pressure Sensitive Silicone Adhesives Stick To Most Surfaces; Retain Their Excellent Adhesive Strength from -55F To Over 250F

The newest products to come out of our development laboratories are pressure sensitive silicone adhesives that stick to almost any material: metal, wood, glass, plastic, rubber, leather, and fabric. Adhesive strengths in the range of 1000 grams per inch at -55 F and over 1000 grams per inch at 250 F are far superior to those of conventional pressure sensitive tapes. The adhesive strength between a silicone steel surface and glass tape coated with silicone adhesive is plotted against temperature ranging from -55 to 250 F in this picture.



These new tapes coated with silicone adhesives include high temperature electrical and electronic applications, weather and moisture resistant wrapping and coating tapes for low temperature applications. One electronic equipment manufacturer is already using these pressure sensitive adhesives to bond mica walls and interconnect mica plate films.

Silicone-based Aluminum Points Outlast Organic Finishes 10 to 1 in Sterilizing Temperatures

Telco sterilizing vessels of stainless steel and other materials at the Lederle Laboratories Division of American Cyanamid Company are being used to sterilize and standardize for 3 hours at 440 F to 1000 F.

The organic aluminum finish on these vessels began to crack and peel, permitting rust to form, after 9 to 18 months.



Flexible Silastic® Tubes Carry Air at 500 F; Prevent Engine Failure Due to Icing Over Jet Air Scoops

Reinforced with stainless steel braid, Silastic tubing requires minimum space; endures heat and high frequency vibration.

It was discovered shortly after certain jet engines were put into service that the formation of ice over air intake scoops could choke off the air supply and cause engine failure.

The solution solution to this problem was to pipe air at 500 F from the compressor to the scoops. But this simple solution involved many problems.

The jet engines were so tightly fitted in their nacelles, that very little room was left for hot ducts of any length. High frequency vibration set up by the engine and plane introduced the problem of fatigue failure.

There was a job for a flexible tubing, a tubing that could carry hot air without softening, withstanding the vibration and permit fast and easy assembly and disassembly. Engineers of the Aeroquip Corporation of Chicago, Illinois, solved the problem with flexible Silastic tubing. Reinforced with stainless steel braid, Silastic tubing is light and flexible. It is held mechanically to the stainless steel braid so tightly that the tube will not collapse even when subjected to a vacuum.

The high temperature problem of sticking, fitting to the heat was also ingeniously solved by the new Aeroquip "Lastic Gum" fittings. The total assembly proved to be so effective that these fittings have been made standard equipment.

Despite internal and external temperatures as high as 500 F, the Silastic tubing has no change in strength after 50 hours.

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OUTDOOR LINES for C-124 and B-45 repair and modification at San Bernardino



WAITING THEIR TURN, B-45 copies line up at Glendale for overhaul

into during early life, but increased
sharply after about 225 hr. of test.

By trying and failing a theoretical
group of engines on paper, it is pos-
sible to determine the actual engine
life expectancy. You can't predict
failure this way, what you do get is
a comparison of engine life, and long-
range planning data.

There is one more task left in the
scheduled bag. Using the survival data
developed earlier, plot a curve of the
percent of engines surviving at any
particular age against the age in hours.
Then if you decide that you'd like to
have X percent of the engines still
surviving at maximum life, pick off the
corresponding engine operating hours that
correspond to that percentage survival.
This makes it easy to establish mean-
sime life requirements for engines.

Where It Applies—General feeling
in the Air Materiel Command is that
statistical methods can be used to
predict life of engines and major ac-
cessories and equipment, but won't
be used as much concerning engine
tests as on airplanes.

Right now, tests are being run on
B-36 propellers to get some start on
statistical data for accessories. Data

gathering is one of the more important
factors in this work, because statistical
methods can only apply where there is
a large amount of basic data avail-
able.

By early September, reporting of
failures from the field will be made
in great number to improve the data
gathering.

San Antonio, Middletown and Okla-
homa City are running their own ac-
tural studies to part of the decomposi-
tion of the Command.

Project IRAN

IRAN—largest and biggest in Secre-
tary—will use the United States Air
Force as estimated \$50 million this
year in overhaul costs of its aircraft.
Now completing its second year of
operation is a maintenance and over-
haul concept, IRAN is turning out
such results as these:

- Three Douglas C-47 airplanes can be
overhauled through contract by the pro-
gram cost of about one airplane.
- Two Douglas C-54 aircraft can be
overhauled for the price of one pro-
gram job.
- Convair's B-29 overhaul costs



Panagra Proves Airborne Radar With X-Band DC6B Installation

Last April, Panagra installed X-Band (3,2CM)
in a regularly scheduled DC6B . . . flying between
the United States and South America.

T. J. Kirkland, Panagra's Vice President of
Operations, says, "Our value equipped plane is
able to avoid all significant weather areas. As a result
it encounters no moderate or severe air turbulence.
Our airborne radar, obtained from Bendix Radio,
has proved highly reliable in 'seeing' storms . . .
day or night at ranges up to 150 miles."

Flight Reports

"On one occasion when lightning filled the sky and
an electrical storm extended across the horizon on
a flight between Panama and Guayaquil the plane
flew through the seas with hardly a bump and

actually arrived at its destination ahead of schedule.
Ordinarily these conditions would have resulted in
significant decreases from course or a long period
of slow flying which in both instances would have
delayed the flight."

There was very little weaving, required to familiar-
ize flight crews with the equipment.

Panagra has specified installation of Bendix
RDR-1 in the new DC-7's which it will receive
next year. It's the first airline to order airborne
radar as standard equipment.

For further information
write Bendix Radio,
Baltimore 4, Maryland.

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Epoxi Forming film used for fasteners, speed production, permit rapid changes in design.

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Epoxi resins, representing a new kind of plastic, have won immediate recognition in the aircraft industry because of their remarkable physical and chemical properties.

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and will withstand hard knocks and abrasion.

Epoxi potting resins safely embed delicate electronic components, protecting them from moisture, shock, and rapid temperature change.

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Epoxi Potting Compounds protect delicate electronic assemblies from moisture, shock, and temperature change.



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from 70° below
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or while being
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far beyond
usual test extremes!



■ MAINTENANCE

have been reduced from \$151,800 to \$77,498.

IRAN is a concept now developed by the Directorate of Maintenance Engineering and sold to the rest of the Air Force; work under the concept began in August 1952. It marks a common sense approach to the maintenance of aircraft.

- **Scheduling-Limited** to the IRAN when a another concept: tri-phased scheduling of aircraft for overhaul. That phrase designates a tri-phased method of scheduling overhaul so that a constant percentage of planes is always being worked on.

The mean is covered keeps its strength up to a desired level of effectiveness while cycling one lot after another of its plants through marine water and sanitation.

Key to the whole concept is simplicity. The many (assumed) and the prime AMA, designed by regulation, is responsible for the maintenance of the particular aircraft, coordinate the scheduling. Incoming planes are given a thorough shakedown inspection, pre-flight checks are made and functional tests are carried out. The aircraft, as given, and equipment records are studied and, the pilot's gipsy lists, maintenance records and other documents are all part of the case history.

Out of this vector of data comes the work list of tasks to be accomplished. Then IBM sets rolling.

P-1 Used To Be Under the old system of maintenance, called DMR, [the standard] was more identifiable by speed and replace, or Depot Inspection and Repair, a place as far overhead as taking apart down to major sub-assemblies, and lots of time was spent on replacing things that didn't really need it.

Engineer poops, wheels and tires, equipment, cables, instruments, and control surfaces come off and were replaced with schult stress. The airplane was pressed up, remounted inside and out, and came off the line like a new airplane.

But not so today. If the engine has useful life, the sum is 0. The cockpit is cleaned up, but there is no new part put on for another push. The final result, of course, is an air plane that has performed its mission just as effectively as the brand-new one that came off the DLR line. The only difference is in the dollar cost of the overhaul.

There is about any component with the mission performance in IRAN, the ultimate job the airplane must do is the guiding factor throughout its evolution.

► **Not So Easy**—This wasn't done with any problems. There aren't any secondary quality standards for eggs and



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Better chance to live!

Downloaded by the Ordnance Dept. for the Air Force—and manufactured by Consolidated Eng'g & Mfg. Co.—cartridge actuated systems make it possible to form most of our rifles and draw back slide

Carriage actuated systems quickly provide means of escape by instantly performing a multitude of superhuman tasks—unlock, bulkhead, remove doors, jettison window seats, move gun mounts, instrument panel, berth lights, table gear, as well as collapse canopies and more!

Lives depend on the instant functioning of these systems in an emergency. There can be no compromise with promises in manufacturing. Consolidated is proud of its record of 100% acceptance by the Ordnance Dept., Air Force, and military aircraft manufacturers.

In addition to its precision production facilities, Consolidated Eng'g & Mfg. Co. offers the *arsenal* industry an engineering and design service for complex hydraulic and mechanical systems to individual customer requirements... precision parts and components, complicated assemblies, hydraulic systems, special tooling, etc. Consolidated engineers will be glad to work with you on any of these problems.



Fig. 18.3 Canopy College-Bellini, N.J. flexible for moving interior equipment away from windows to facilitate safe egress.



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■ MAINTENANCE

crashed, for example. It is not enough to define and control quality in one part, but how can it be done for rebuilt ones?

There is also a lack of hard-hat data on accidents. Too often, there have been pulled and scheduled for rebuilding at military airports. Project Break Check, a sort of scaled-down IRAN for such component items as starters, generators and the like, has begun to pay off a dollar toward applying the same philosophy of replacing when necessary.

IRAN personnel spend hours in searching the records of the component and submit for their data to scientific inspection and repair. Based upon the results of these studies, new standards for rebuilt items have been established for their items.

In contact maintenance, the IRAN concept is turning out three C-47s for the price of one, two C-54s for the price of one. Accidents are being reduced through break-check techniques, saving about \$70 million in calendar year 1973.

There have been two C-47 and three C-54 contact maintenance items which are on the new concept since January 1973.

And next? The Air Force was that IRAN will be applied to all aircraft in service, as possible. Also, B-47, B-52 and C-124 have not been fed with IRAN thinking and techniques, and within a short time, the IRAN concept will be standard for the Air Force.

Other Projects

More than half of ANAC's overall maintenance dollars was spent for contact maintenance during fiscal year 1974. This work was specialized toward not to provide time for the use of resources and to keep the ANAC working on the most vital workloads.

► **Base for Expansion—Current AF policy is to keep its own depots and ANACs running on an efficient basis to handle the workload judged most vital for carrying out the mission of the Air Force.**

The kind of workload that generally is, forward and to provide contractors might be helped by one one of the following examples:

- **Overload workload**, where ANACs already loaded with pre-scheduled work for an indefinite period.
- **Reluctant workload**, where commercial facilities are available or a special type of airplane might require the specialized knowledge available at a contractor's plant.
- **Commercial bases**, such as those where and vehicles, where the local commercial outfit is "back" set up

RCA T's

Radio-Controlled Aerial Targets—called R-Cats—are now the standard targets used in primary training of fighter pilots and advanced and airborne primary areas of the Armed Forces. These drones are maneuvered from the ground to simulate the attacks of an enemy aircraft; they are an expensive substitute for "the real thing". Precision-built R-Cats are supplied in quantity to the U. S. Army, Navy, Air Force, and National Guard by Radioplane Co. They are one more product of the versatile Northrop team which has built the famous long-range Scorpion F-69 interceptors, Search XD-62 pilotless bombers, range finders for Army tanks, and other material constructed to rigid specifications of the U. S. Department of Defense.

Radioplane Co.

a wholly-owned subsidiary of Northrop Aircraft, Inc.



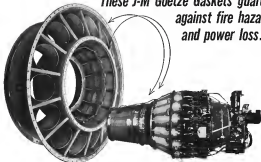
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**These J-M Goetze Gaskets guard
against fire hazard
and power loss...**



Arrows point to J-M Goetze metallic gaskets on the cover and water manifold, and their application location on the J43 turbojet engine outfit line.

...on powerful turbojet engines like the J43

Sealing the laser cut cover flange on the J43 to prevent leakage of fuel and steam into the turbine is another example of the many tough, critical sealing jobs entrusted to Goetze custom-crafted metallic gaskets.

For this particular service condition, the Goetze gasket specified is made from a flat gasket design... with the manifold both edges rolled inward to fit tight and yet tight in service.

There is a Johns-Manville Goetze gasket for practically every jet en-

gine requirement. Goetze craftsmen can fabricate them in necessary shape or size for sealing gaskets, compressor seal, bleed air, waste gas lines, combustion chambers, fuel nozzles, turbine drain lines, etc. Backed by more than 60 years of Goetze "know-how," these durable gaskets are solving many of industry's most complex sealing problems.

Why not write for further information about Johns-Manville Goetze gaskets... and other J-M flight-proven products for the aviation industry. Ask for your copy of "Brochure AV-1A." Address: Johns-Manville, Box 60, New York 16, N. Y. In Canada, 159 Bay Street, Toronto 1, Ontario.



Close-up of J-M Goetze metallic gaskets used on cover and water manifold gaskets on jet engine turbine flange.

IMPROVEMENT

with both and equipment to handle the job. A simplified overhaul by the prime contractor.

The last point is worth elaborating. It means that a prime contractor, manufacturer of an engine or an air plant, will perform the last overhaul on his own product. Air Force says there are many advantages here. Overhaul procedures and the equipment will be improved in a short period of the manufacturer's problems. Modifications can be made quickly accomplished because of the instant availability of special tools and construction furnished parts.

The prime contract manufacturer should be in a better position to forecast his spare parts requirements, and to develop and refine tools for overhaul.

► **Jet Repair-Shop** Three ago, it was announced that the jet engine was basically a simpler engine to maintain in the field. Korea provided the real test of this idea, major overhaul at base level was the procedure then.

By now, ideas have piled into policy, and the Air Force does its jet engine major repair work in the field at the base level.

Air Force says that program has been extremely effective in increasing the life of jet engines, as an average figure, AF officials say that engine life has been doubled.

Some data on the General Electric J47, for example, showed that at one time, engines were averaging about 110 hr. before being removed for overhaul. When the major repair was done at the base, the figure jumped to about 225 hr. before overhaul.

► **Technical Order-Base** of a crew chief's job, the Tech Order, and the system which updates them are in the maintenance process.

Present distribution of Tech Orders is a stack 75 in. high, or about 2.2 billion pages. Each USAF base has been required to keep a complete file, a procedure which gave SAC wings complete sets of TOs in their base towers.

These approaches have been used to simplify the current system. First, the numbering scheme has been revised. A B-47 TO, for example, would have been numbered like this: O-13 ENB 75, a long and diagonal designation. Under the new system, this becomes 1 B-47 B-75, which seems that it is the 76th TO for the B-47 aircraft.

Second, the books are being rewritten along the system concept. Instead of a book on the general electrical system, there are now books on the specific electrical systems, if the

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differential devices, pressure controls, expansion joints, hydraulic mechanisms, as flexible connections and more applications.

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■ MAINTENANCE

mechanism in working on radio, he doesn't have to pore through instructions on the radio lighting to find the exact he needs.

Third, the distribution system is being revised. Bores will only get the TOs that pertain to the aircraft they operate. Bores will become the property of the crew chief, to have with him, instead of making him trek to the library to get the books he needs for each job.

Distribution of TOs will be the responsibility of the manufacturer and the power AMUs.

► **Sight Line**—The Directorate of Maintenance Engineering has a job of customer service to do. One such aerial example was Project Sight Line, the technical support of five control systems used in the Pan East theater.

Specifically qualified technical personnel were sent to Korea for temporary duty of about three months in early 1953.

These men, to support the maintenance and logistic support of the A-4 ground equipment and to modify the AFG-30 order and the MA-3 fire control system in F-5s and F-80s. In addition, they had to establish a depot in the theater for overhaul of A-4 ground components.

Spares and more than 30 tons of test equipment accompanied the project team. The depot was established and training courses started in the use of the depot overhaul equipment.

Test personnel delivered critical items of test equipment to each USAF fighter expedition in Korea and Japan. They trained pilots and main technical personnel in the use and use of MA-3 fire control systems.

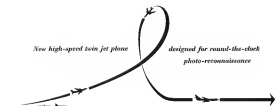
A special assignment system team was designed and hurried to act as a complete instrument shop, and served that purpose for fighter organizations until they could set up their own permanent shops.

The project was completed at the end of June 1953. It would be hard to estimate the savings in terms of dollars, says the Air Force, but it must have been a considerable amount.

► **Epilogue**—These are some of the jobs and techniques that are the daily coin of the thousands of people in the Directorate of Maintenance Engineering.

The jobs they do are sometimes routine, sometimes directly unpleasant, but always important. The skill of the crew chief on the side of the pilot, the planning at the production controller tier in with the strategic planning of Headquarters USAF.

Other people build the airplane, others transport them, still others fly them. But maintenance engineers keep them flying. ■ ■ ■



—the Douglas RB-66

Now in production for the U. S. Air Force, the Douglas RB-66 will be one of the most versatile photo-communication planes ever designed.

Complete performance data is still restricted, but this much can now be told. Powered by twin jets, slung in

pods from its sharply swept wings, RB-66 will fly in the 600, to 700-mile-per-hour class. Range will permit deep penetration for all-weather, around-the-clock photo-reconnaissance or mapping. Photographic equipment will be of the most modern to collect

detailed information by day or night.

Development of RB-66 is another example of Douglas leadership in aviation. Plans that can be produced in volume to fly faster and farther with a bigger payload are a basic rule of Douglas design.



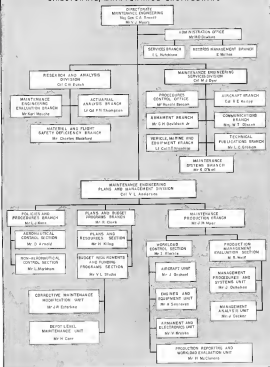
Built to fly in the U. S. Air Force

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new **ARC**
course indicator gives you

two instruments

in one!



ARC #16706

New users of the light, compact ARC Type 15D navigational receiving equipment can employ a single panel instrument that performs the work of two units previously used. The cross-pointer meter and the course selector have been combined into one part that fits a standard 3 1/8" instrument hole.

Thus saving an instrument panel space is important, particularly now that dual VOR installations are so popular. In addition to the space saving, installation costs are cut. Ask your dealer to specify the new #16706 Course Indicator as part of your 15D installation — whether single or dual. The indicator may be purchased separately for use with older Type C and D equipment. Write for complete data.

TYPE 15D EQUIPMENT

Compact... lightweight... CAA Certified
for Airborne Reception of One Directional
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Southwest Radio • GCA Radio



#15D Receiver with D-104 Synthesizer
B-42 Connector, D-14 Jack and
M-10 Mounting



Course Selector and
Cross-Pointer Meter
fits a single unit



C-22A Control Unit, M-10 Mounting



A-15B Antenna



Aircraft Radio Corporation

JOHNSON • NEW JERSEY



0900 Stepping up on their work stand, the crew removes outboard engine cowling.



0906 Quick disassembly of J47 electrical, fuel, and oil lines are completed.



0911 Crews use lift engine forward as replacement rolls into background.



0914 Engine is moving away from wing as new J47 is pulled into position.



0919 New engine hooked up while crew installs J47 fuel, oil, and electrical lines.



0924 Attention "bullet nose" and cowling are clamped on jet before running engine up.



Simple design of G-E J47 helps S.A.C. crew make 25 MINUTE ENGINE CHANGE!

McDill AFB photos show how G-E engines, Boeing wing pods, and S.A.C. ground crews have cut bomber maintenance time and costs

A Strategic Air Command B-47 ground crew recently changed a G-E J47 jet engine in 25 minutes. We mention this for two reasons: twenty-five minutes is almost *unheard of* the time it used to take to change a WW II bomber engine. And the 25-minute change is typical of the ways in which the J47's clean design and durability help S.A.C. save time and money.

Good design: Easy maintenance

The J47's relatively simple construction makes the engine very easy to maintain, compared to other types of powerplants. For example at McDill AFB, S.A.C. crews use up to 600 hours fewer J47's before major repair. This is nearly twice the major repair

average of S.A.C. piston engines. And, naturally, the cost of J47 maintenance—and the human effort involved—is less.

Good design: Long operating life

Proof of the J47's durability lies in the fact that B-47's attached to the 359th Bombardment Wing have gone more than 600 hours without a single engine change. That's the equivalent of 15 nonstop globe encircling flights. A *Tempe* newspaper has quoted a B-47 ground crew as calling their J47's, "The engines that never quit."

Facts like these illustrate the J47's contribution to the Strategic Air Command. Section 232-2, General Electric Company, Birmingham 2, N. Y.

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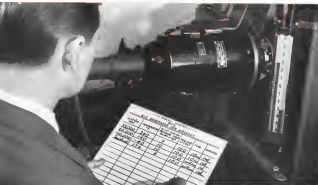
GENERAL  ELECTRIC

EASE OF J47 MAINTENANCE is illustrated by this photo of a S.A.C. B-47's outboard wing pod. J47 handles can be removed quickly for minor repairs and overhaul.

LONG J47 OPERATING TIME BETWEEN OVERHAULS is quoted by B-47 No. 10334 of S.A.C. 359th Bombardment Wing. Aircraft flew more than 600 hours without a single engine change.

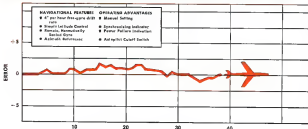


New G-E automatic a-c electrical system



New G-E high-efficiency ac generator has no bearings wear 1%, and offers full load recovery in about 1/10 sec. Available ratings: 10 to 50 kw, 340/1400 rpm, 1700/1400 rpm, 120/200 rpm.

New G-E compass system reduces aircraft drift rate 66—80%



Low drift of gyro system proved in laboratory and flight tests. The above drift curve was obtained during a roll-pitch-yaw test on a G-E gyro unit. This test, conducted by an outside equipment laboratory, showed that at no time did the drift rate exceed 2" per hour—66-80% reduction over previous systems. Flight test confirmed later updated laboratory findings.

delivers load at 260F

A new, fully automatic parallel a-c electrical system which eliminates manual switching, and delivers rated load at higher ambient temperatures than ever before possible, has been developed for jet aircraft by General Electric.

Designed for supersonic dash

Designed specifically to meet the high ram air temperatures of supersonic dash, this new G-E generator system provides the best voltage regulation and most advanced system protection available in production today. The automatic system delivers full load at:

- Sea level with 174 F cooling air at 4 inch water drop (nominal)
- 40,000 feet with —40 F cooling air at 10 inch water drop (nominal)
- 60,000 feet with 140 F cooling air at 10-inch water drop (nominal)
- 70,000 feet with 202 F cooling air at 7-inch water drop (nominal)

Speeds take-off, saves pilot

The first completely automated a-c system ever produced, the new G-E equipment begins operating as soon as the pilot starts an engine. The system contains only two toggle switches, which can remain "on" at all times unless a fault develops. This eliminates a series of pilot functions, and sharply reduces time required to become airborne after the pilot climbs into the cockpit. System control and protection is fully automatic.

Single source for complete system

General Electric offers a single source for complete a-c or d-c power generation systems for any aircraft. For more information, contact your nearest G-E aviation specialist, or write Section 210-46, General Electric Company, Schenectady 5, N. Y.



Major components of the new G-E system in addition to the generator are:

1. New 4" shaft regulator (GR-1) designed to last the life of the aircraft through roughness is only 200 cubic inches and weighs only 10 lbs.
2. Control and protective equipment (GR-2) internally located and includes one fully gaseous control panel weighs only 20 lbs. for a single-generator system and only 10 lbs. for the parallel generator systems.

drift rate 66—80%

A new compass controlled, damped gyro system, which offers a free gyro drift rate of only 2" per hour—66 to 80 per cent more efficient than present systems—has been developed by General Electric for helicopters and fighter aircraft.

Weights only 17.5 lbs.

Compact and lightweight (approximately 17.5 lbs.), the MA-1 compass system is designed to meet the requirements of any synchronous motor indicator, and will operate from all compass transmissions built to Air Force specification AF-2035.

Accurate, stabilized heading information

The MA-1 system offers accurate, stabilized heading information continuously through 360° in azimuth when directed to the earth's magnetic field through a medium remotely located compass. Providing a normal driving rate of approximately 2" per minute during compass-controlled operation, the MA-1 system also provides for controlled latitude-drift compensation.

Aircraft systems development

For additional information regarding reliable aircraft systems development, contact your G-E aviation specialist or write Section 210-46A, General Electric Co., Schenectady 5, N. Y.



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New G-E armament system gives jet bombers



This new 20 mm system is a result of G-E's "integrated system" approach whereby a group of engineers is responsible both for development and installation of a system for greatest efficiency and ease of maintenance.



Cold and hot chambers with temperature readings from -80 F to 170 F are only two of the elaborate tests G-E armament systems undergo to help insure maximum flight efficiency.

automatic defense

A remote-controlled 20 mm armament system, capable of tracking, tracking and hitting hostile aircraft even in the night or fog, has been developed by General Electric for high speed jet bombers.

"Packaged" protection for B-47E and RB-47E Under security wraps for three years, the G-E fire control system provides more reliable, automatic protection for the Boeing B-47E and RB-47E jet bombers. Compact, the 20 mm system is delivered packaged, tested, and ready to be installed as a complete rail section.

Automatic warning, tracking, correcting

This system performs the following functions:

- Provides automatic radar warning of approaching aircraft
- Automatically tracks and positions gun on selected target
- Automatically accounts for windage, ballistics, and lead action by means of an electric computing network
- Fires gun electrically when target is in range.

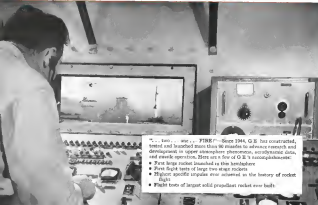
System Engineering

Bomber Engineering is advanced as a result of the integrated, effective, compact system. Component system engineering is one reason why almost every U.S. operational heavy and medium bomber today is equipped with General Electric armament systems. General Electric Company, Schenectady 5, N. Y.



Remote-controlled G-E armament system gives the Boeing B-47E and RB-47E jet bombers a heavyweight punch in the rear. Guided by radar, the 20 mm system can track and hit enemy targets.

New land-sea-air uses for rocket propulsion



"...and...we...FINISH" Since 1944, G-E has constructed, tested and launched more than 90 missiles to advance research and development in upper atmosphere phenomena, aerodynamic data, and missile operation. Here are a few of G-E's accomplishments:

- First large rocket launched in the hemisphere
- First flight tests of large two stage rockets
- Highest specific impulse ever achieved in the history of rocket flight
- Flight tests of largest solid propellant rocket ever built

under study by G.E.

Two years ago, rocket propulsion had but one use — to launch missiles. But today, rocket power is a source of high pressure, high speed, high temperature gases and power can be used in such applications as torpedo propulsion, outboard engines, high-speed flight, thrust augmentation, rocket boosters, and engine power. High speed research sleds, glider take off and landing, response wind tunnels, racing, plus many additional land, military and industrial uses which will be brought out by research and development.

Experience, manpower and facilities make it possible for G-E to design and develop rocket systems or rocket propulsion systems for use on land, sea or in the air.

The amazing growth of rocket propulsion offers a challenge to the ingenuity and imagination of American industry. This challenge — application — can be met only through continuous research and development. To this end, General Electric offers its successful experience, its trained manpower, and its extensive facilities. General Electric Company, Schenectady 5, N. Y.



TORPEDO PROPULSION

THRUST AUGMENTATION

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For all types of aircraft and guided missiles . . .

G-E Ground Power Equipment Gives You Accurate Testing, Servicing . . . Faster Starts

General Electric's complete line of ground power equipment—field proved—assures you of the right auxiliary power for aircraft starting, servicing or testing requirements.

AT SODKHEID AIRCRAFT CORP., Marietta, Ga., G-E ground power equipment is used to test a B-57, jet bomber. The complete line of G-E equipment assures you of accurate instrument and electrical system tests plus faster, more reliable starts.

READILY ADAPTED to stationary installations or mobile use, G-E ground power equipment provides:

1. Fast, "every-time" starts for jet or reciprocating engines
2. Ground checking and testing of instruments, devices and guided missiles on flight ramp or in jet installations.
3. Auxiliary power for shop and hangar repair areas.
4. Aircraft factory production testing for any type of aircraft electrical equipment.

ACROSS THE COUNTRY, aircraft manufacturers, airports, the armed forces and ground power equipment manufacturers have installed and applied these depend-

able, accurate G-E units and components for every auxiliary power use. General Electric has devoted extensive field studies to ground power requirements, and the engineering experience gained through the design of packaged power equipment over the years assures you of getting dependable, low-maintenance performance.

WHATEVER YOUR NEEDS in ground power, General Electric can engineer the right equipment to meet specific conditions of your operating needs and location.

Specify General Electric when you need more reliable and accurate ground power . . . G-E Aviation Specialists are always ready to assist you. For further information, contact your nearest G-E Apparatus Sales Office, or write General Electric Company, Section 821-2, Schenectady 5, N. Y.

LET G-E HELP SOLVE YOUR GROUND POWER SUPPLY PROBLEMS



FREQUENCY CHANGER PACKAGES are available in 15-, 15-, 35- or 60-KVA ratings for the supply of 60 cycle power. When here regional servicing is also available for more accurate instrument and device testing or calibrating.



MOTOR DRIVEN UNITS, like this one in a jet engine test power unit, are available in 10-, 20- or 100-hp. 18-volt ratings. Suitable for mobile use or stationary installations, these units give you accurate and more reliable ground power.



DEFINABLE COMPONENTS (one end of a generator and motor-generator sets) are available for engine drives, self-powered or stationary power units. Designed for you, they meet the most stringent government and civilian requirements.

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THUNDERING B-36 symbolizes the combat readiness of USAF's major delivery system for atomic and hydrogen weapons.

SAM-SAC Keeps B-36s 'Ready to Go'

By Frank Shea, Jr.

Fort Worth—If the whistle blows tomorrow for an all-out shooting war, this country's ability to administer devastating retaliation would depend largely on the venerable B-36.

As the only heavy bomber now in operational service capable of carrying atomic and hydrogen bombs, the Constable just shouldn't responsibility for spearheading the striking power of the Strategic Air Command. Its ability to deliver atomic and hydrogen weapons over intercontinental range at the very instant that will spell the difference between victory and defeat.

No one is better aware of this responsibility than the people here at General's Fort Worth Division, headquarters of the B-36. Working closely with the Air Materiel Command they are doing everything in their power to make that Gen. Curtis LeMay's striking force is prepared and ready to go at a moment's notice.

This effort has taken on the concrete form of a major \$40-million per year

overhaul, modification and modernization program involving an estimated 6,000 workers. Big emphasis is on modernization and modernization, but all necessary field level maintenance also is provided.

►SAM-SAC—Known as "Operation SAM-SAC" (Specialized Aircraft Maintenance—Strategic Air Command), General's program is a result of the final contract of this kind to be awarded by the U. S. Air Force. Its demonstrated success thus far, coupled with the aid and interest of other leading U. S. aircraft manufacturers, could well lead to a new overall Air Force maintenance concept.

SAM-SAC is a three-way deal, with SAC as the user, General's as the contractor, and AMCC's San Antonio Air Materiel Area as the supplier. All three coordinate and work together with the precision of a well-oiled team. This, probably more than anything else, is the key to the program's success.

General has set up SAM-SAC so that the entire B-36 fleet can be run through the program in three cycles over a six-year period, with no more than about 30 aircraft out of service at any one time. That the striking capability of the long-range bomber fleet is never seriously impaired, and LeMay is assured

■ MAINTENANCE

of having his machines strength "up front" at all times. Only 50 days are required, door to door, for any plane to go through a cycle, and General feels it will be on the fact that it has never been late with a delivery in the two and a half years the program has been in existence.

SAM-SAC Cycle

Actual work on any SAM-SAC airplane begins 10 days prior to the time it is received by General's. At that time, the SAC unit to which it is attached forwards all of the ship's records to Fort Worth for examination and analysis.

In this way, the SAM-SAC people are able to establish the major portion of work that the aircraft will require several days before its arrival. This saves precious cycle time, permits General's to source parts not as fast and arrive in an added incentive for SAC to keep all ship's records right up to date.

►Planning—General's planning begins here. Upon arrival, several records go directly to the planning board, a permanent organization consisting of representatives from each of the major departments responsible for the aircraft's placement at SAM-SAC.

Side parts of this board is to ex-

STUFFING OF outgassing engine, control surfaces and other parts is accomplished at work and shortly after arrival.



SAM-SAC PROGRAM begins here at the stuffing station where all incoming aircraft receive inspection and inventory check.



DOCK WORK begins as B-36 gets structure inspection and loose parts are removed.



BEAR B-36205 are removed and sent to conditioning shop for a thorough going over.



VERTICAL FIN being installed on aircraft after extensive conditioning and repair.

tabular and release an actual task (work) to be accomplished during the specific cycle) for each aircraft and release replacements to that task for additional, as determined as dictated by the availability of L-1.

In establishing the actual task, the planning board performs the following functions:

- Screens recurring inspection records
- Examines aircraft historical records
- Checks service lot availability records, working closely with SAMMA
- Screens maintenance parts report
- Determines average replacement and task order requirements
- Establishes parts availability
- Determines applicable ECAs (Engineering Change Proposals)

Planning is the key factor. To obtain maximum efficiency, all elements in the SAMSAC program are scheduled in a manner that allows perfect integration in order that each moment of work within the total task for the aircraft can be accomplished in the most logical sequence. Task planning is carefully monitored so that types of work are allocated to crews that specialize in particular skills.

Approximately 35,000 man-hours are devoted to each phase that goes through the program, which gives about idea as to just how extensive a job is done. Not only is all modification and modification work performed, but all necessary field level maintenance tasks are accomplished as well.

The aircraft is completely checked from end to end, so that when SAC units get it back they know that they have a clean, serviceable ship that is "ready to go." This does not mean that a lot of unnecessary work is performed. The ship goes out clean and ready for service, but not like new.

No Face-Lifting—Convair officials continually emphasize to personnel that they are not in business to make the plane pretty. As long as a part is completely serviceable, it stays; removal of debatement taking, discoloration etc. For example, flexible joints, ducts or accessories are bonded up to be replaced. But failed or discolored ducts or accessories are replaceable if they are logical.

A variety of color blends in required areas also is acceptable, as are shade amounts with sheet weather marking or even with wall coverings which do not go through the end. The most is base of rubber that has been bent or crimped on installations, but not broken-as long as it is not cracked.

This "serviceable but not like new" policy means personnel maintain and plan a big part in maintaining the amount of time an aircraft is kept out of service.

Since the entire philosophy of SAM-

SAC revolves around the program requiring of the B-36 first for maintenance and conditioning, inspection and modification is progressively accomplished concurrently with normal maintenance during each of the program's three cycles.

Disband in Three—In order to keep the "down time" of SAMSAC planes to a minimum, Convair has divided each ship into three basic sections, one for each of the three cycles (see chart's sketch).

While one-third of the plane is undergoing maintenance and conditioning in a cycle, the remaining two-thirds receive a "field level" major inspection. In this way, each section takes its turn in its designated cycle, but the entire airplane gets a thorough going over each time it comes to Convair's Fort Worth plant.

Operation Inspection Log—Upon arrival at Convair, each B-36 first proceeds to the record station where a servicing shop has a list of all work necessary to prepare it for SAMSAC. This information is issued in the form of an "Operation Inspection Log."

Inspection and necessary work then quickly performed. Electronics, seats and loose equipment is removed, and a visual and physical check is made to determine the general condition of the plane.

Next the starting engine run is performed and engines are prepared for extended storage. A "power on" check is made of the entire electrical system and operation equipment and all fueling edges are removed. The moment the ship arrives with the aircraft is then determined and pointed as returnable to Air Force Fuel and all tanks are checked and flushed, and maintenance and preservation operations on the engine commence.

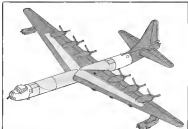
Second stop for the incoming B-36 is the painting station where all fuel tanks are purged by drawing fresh air through the rough corners to remove oil or solvent vapors. This operation is performed in a refitted area and only by personnel with specialized training. The aircraft then is checked for safety by the Fort Department through use of an explosives and proceeds to its next stop—the wash station.

Here, the propellers and accompanying engines are removed and washed, as are the control surfaces. Interior and exterior of the ship is then cleaned and washed, all removed components are forwarded to their respective crews drawing areas, and then the surface is forwarded to its specially assigned work fact.

Quadruple Work—All SAMSAC work is done in quadruple, permitting work, more planes to be worked on at one time, and also leaving the in plant



CLOSER SIGHTING and inspection requires specialized crews on complex aircraft.



SAM-SAC CYCLE out B-36 into three sections, with each third undergoing overhaul and maintenance in its own turn while the other sections receive field maintenance.



SPECIAL TRAIN equips a shuttle service, delivering B-58 outboard and engine parts to work docks and reconditioning shops.

production facilities from the actual production planes.

While the last B-58 production model was rolled out this month (Aviation Week Aug. 9, p. 15), Convair still will want to make sure the last a line and ready to go—especially since the B-58 Header development program has gone in high gear (Aviation Week May 24, p. 15).

Shops and Docks—Once the removed component parts have been sent to their respective reconditioning shops and the references sent to their work docks, the real work of SANSAC begins.

In the reconditioning shops, elements are disassembled—trim tabs and servo tabs being removed, along with access doors and electro-mechanical coverings, stress- and oil control mechanisms, etc., are closely inspected. All necessary work is then accomplished prior to reassembly.

In the outboard, intake and flap shops, similar processes are repeated, with all work undergoing rigid inspection upon completion.



ALREADY READY, having finished work shop phase, SANSAC aircraft is prepared prior to undergoing extensive flight testing.

Assembly—Inspection—Assembly comes in for special attention, with all trim and fix control equipment being shipped to specific government contractors for modification and maintenance.

The parts are disassembled, reconditioned, repaired, reassembled and all mechanisms are functionally checked with dummy installation.

Upon receipt of the modified trim and equipment, workers mount each unit on a test stand for functional and continuity checks. Interference tests are performed on each trim.

The parts are then mounted, bolt-tightened and lubricated. All lights are synchronized and checked, and final checks are performed on each component. All turret controls and related equipment are adjusted, operated and inspected for synchronization on the aircraft.

The electro-mechanical and hydraulic units border the reconditioning of all mechanisms, electro-mechanical and hydraulic units removed from the ship. Records are located to field level type

reports that are within Convair's scope before, while items requiring more extensive repairs are retained to the appropriate AMA depot.

Antenna Maintenance—In the area of antennas, too, the extent of service or repair performed is limited to a field level within Convair's capabilities, with all other work being forwarded to the appropriate overhaul depot.

The electronic literature at Convair covers equipment removed from each aircraft to eliminate any confusion or mislabeling, tests, servicing, etc., are rapid. Preventive-type maintenance is performed on all other equipment. Foreign matter is removed and inspection is made for loose connections, worn plugs, mislabeling, etc., or parts and condition of wiring and lenses. Each unit is revised and lubricated as required.

Each area is checked for applicable test order compliance. All applicable TUs, engineering change proposals and other directives, within Convair's capabilities and not previously accomplished,

MAINTENANCE

are incorporated in the equipment at that time.

Last step before equipment is ready for installation is a bench type functional check to insure proper operating condition within an entire system.

Prep & Postflight—On completion, Convair passes the extent of discussion by the actual age of the unit and the number of total units open on it. All extensive repairs and major overhaul are performed by the Air Force Air Materiel Area.

Engine gets a real going over, with the powerplant, as received from each SANSAC aircraft, being dismantled into three basic components—the fuel system, the engine, and the exhaust assembly.

At the components are separated, the fuel structure and engine are forwarded to their respective shops for further disassembly in general cleaning, normally being sent to the transportation of service units.

The exhaust assembly remains on the mobile dolly to undergo its own extensive reconditioning operations. A check sheet repair shop is located in the area to expedite cleaning as repair units are on any components or parts that are being received from within components.

While all this is going on, deck workers are busy putting the airframe through its paces at the work docks—performance maintenance, reconditioning, modification and assembly operations necessary to continue to the production line.

Deck Area—In order to understand the actual work dock operations, a brief description of the deck area themselves is necessary.

Since they are outdoors, these docks had to be ingeniously designed to protect personnel and equipment from the elements throughout continuous year-round operations. Also, they had to be designed to provide the necessary scaffolding and platforms for assemblies to all existing surfaces of the wing and nose section of the aircraft.

The size of the B-58 presented a tremendous problem in the design of such a work dock station. Convair's solution incorporated all these features:

- Storage racks for all assemblies and parts being repaired, for accessibility and easy installation.
- Stock room with personnel to receive, file and control the planning operation cards, service kit and standard parts to be available on each aircraft that it is to be reconditioned.
- Area furnished with sheet metal equipment and materials necessary to eliminate maintenance-type parts for minor repairs and perform cleaning operations as required.
- Facilities for storing service tools,

100,000
horsepower

50,000
feet high

2,000
miles an hour

from a
1,500 lb. engine

Ramjets by
marquardt

AIRCRAFT DIV.

Van Nuys, California

THE WORLD'S LARGEST JET ENGINE RESEARCH AND DEVELOPMENT CENTER

A New Approach to PANEL LIGHTING



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MAINTENANCE



SAM-SAC PROPELLER REPAIR AREA. Come in, picture the extent of prop diameter by actual age of the unit and number of take-off cycles on it.



PROPELLERS ARE REINSTALLED after major inspection during SAM-SAC cycle. All repairs, repairs and major overhaul are performed by Sam Antonio, NMA.

field engineers and chiefs and various types of personnel and other gear.

- Heating, air conditioning and fan-blowing units to further expedite the all seasonal operations.
- Field office areas for shop supervisory personnel.
- Storage & Jacks—Prior to actual dock work, SAM-SAC aircraft are checked, kitted and moved within each dock station, as necessary for the dock phase to be accomplished.

Shoring equipment consists of field jacks, stabilizing towers, crib blocks and mooring cables. The plane is raised by jacking the main landing gear struts, supported by a nose jack. A steel steel block and pad are inserted under each main landing gear column to support the aircraft in the raised position.

Delivery of the struts elevates the wheels to a raised position. Field jacks and towers are positioned at designated points for additional support and to secure against any movement of the positioned aircraft. Crews don't taking any chances after the downtown branch of September 1972 that launched more than 70 of the big turbofan engines out of commission.

Dock Operations

The "in dock" period represents a large percentage of the total elapsed time for an aircraft in SAM-SAC Program box, to be accurately measured in order to ensure that schedules are met without aircraft oversteering its dock time.

► **Six Phases**—For this reason, Crews

MAKING THE CHIPS FLY

ON BIG MACHINED-FROM-SOLID ALUMINUM PARTS FOR AIRCRAFT

**EKSTROM,
CARLSON
No. 400**

CAV-RO-MIL



and the result...



MORE ACTION

The center is driven at either 5000 rpm or 7500 rpm by a direct-connected fly-wheel motor on the head. Above the head is a vertically adjustable gear that engages the engine mounted on the "rotating", so descriptive the result of the head and produces all the required motion. The rigidity of the head and follower gives high production milling within close tolerances.

CONTROLLED BY SIMPLE "JOY STICK"

Three of the head in all directions and at variable speeds is instantly controlled by a single lever on the control. Manual maximum traverse speed is 120 inches per minute. Each given traverse was given and returned and the lower piece was also then milled. These parts are produced on this machine in 1/3 the time required by ordinary methods.

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1400 RABROAD AVE., DEPT. A-6
ROCKFORD, ILL.

FOR GREATER AIRCRAFT PRODUCTION!



and the result...



divides the work task on each step into its separate phases. Each phase represents a block of pre-planned work, scheduled to be completed prior to entry into the next phase. All work steps are initiated by phases scheduled into separate sections or types of shifts in order to gain maximum utility from each case box.

While the step is in the dock, seven final cases are assigned to specific sections of the aircraft to perform general type aircraft work. These cases, in turn, are supplemented and supported by specialized cases that perform work of great skills.

Five of the final cases are assigned

to the nose, bomb bay, tail, wing, and ports, while the remaining two are assigned to those engines each. The supporting specialized cases work over the instrument, electronics, visual proofing, ground, fuel, oil, hydraulic, engine wing fuel, auxiliary fuel, engine, electrical operations and the hydraulic system.

Phase One—The leveling, shoring and section operations are accomplished in Phase One of the work dock sequence. In addition, all a/c are opened up and a thorough inspection is made to determine the required maintenance task.

This task is integrated into sub-



Three "pictures" tell the tale . . . Simply, Accurately!

KEYSTONE 3-POSITION INDICATOR

Requires but a Small Space—Gives a "BIG PICTURE" on Operating Conditions

The leading gear markings shown above are but one of eleven different instrument applications. With the story "at a glance" on flap position, oil pressure or temperature, fuel supply and other operating conditions. Removable, easy-to-install in both small and large planes.



High Quality Construction

- Impervious to dust, moisture, gases
- Meticulously sealed brass case

- Filled with inert gas
- Optically clear glass window
- Corrosion resistant finish



KEYSTONE
WATCH CASE DIVISION
RIVERSIDE METAL CO.
Riverside, New Jersey

sequent phases concurrently with the planned maintenance task.

Additional preposition-type work is accomplished in this phase by removing parts or assemblies in the following categories:

- Out-of-use items.
- Malfunctioning items (flight apparatus and servicing inspection requirements).
- Obsolete items (items removed to prevent damage or allow accessibility).
- Obsolete items to be replaced by new configurations.
- Damaged replacements.
- Remote items (items which are more economical to repair "off-shop").
- Test requirements (items which must be tested and checked out on "bench shop" equipment).

Wing integral task work also is performed, consisting of structural and sub-assembly and structural work in the oil line area.

Phase Two—Moving into Phase Two, installation of key replacement parts and assemblies of a structural and primary nature is accomplished concurrently with reconditioning and maintenance-type repairs of the same category.

Reconditioned structural engine nacelles, propellers, ailerons and elevators are reworked and rigged, while the jet powerplants are inspected and reconditioned. Overhaul and maintenance items are replaced, all longer bolts are removed and replaced, and serviceable bolts are reworked.

Center panel and stabilizer leading edges are reworked, as are the wing and stabilizer tips, while wing integral task work in this phase consists of structural rework in the wing tanks and sections of bonds. Old bonds are removed.

Phase Three—This phase is concerned with the recondition of electrical and plumbing kit and replacement parts concurrently with the reconditioning and maintenance-type repairs of the same category. In addition, nonstructural flaps and elevators are reworked and rigged, while auxiliary fuel tanks are reworked and tested.

The engine panel is then touched-up, wing tanks are air tested and the oil lines are flushed.

Phase Four—In this phase continuity checks are made on all electrical systems, while pressure tests are made on all systems.

In the next step, electrical operation checks are run on all bomb-bay target decoy and engine, the soundproofing, de-ice and engine are removed and cleaning of all areas approximately begins in preparation for the final inspection sequence.

In this same phase, the outer panel of the wing is inspected. If accepted by



AMERICAN LATEX NEW STAROVAL

From a liquid—poured in place! For strengthening concrete for this analysis (See next page.)

STAFAM PROVES SUPERIOR for Strengthening Core of Thin Airfoils

STAFAM was selected as the core material in major portions of the thin airfoil sections of the Del Mar Delta target.

Del Mar Engineering Laboratories specializes in advanced target design. After evaluating the highly sensitive and accurate fire control systems now under development, Del Mar engineers selected STAFAM. This target is designed to meet the requirements of the Air Force's Armament Center for a structure capable of withstanding various scoring devices

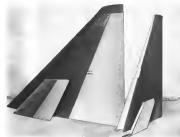
and performing economically in the speeds and climates compatible with anticipated operations. STAFAM proved distinctly superior on the basis of simplicity, low moisture and lubrication needs, high structural strength, limitation of weight, dimensional smoothness of skin surfacing, and flotation for water landings.



Del Mar Delta in flight.

"STAFAM came on our Delta structure has proved rugged even with the severe handling and abuse associated with target landings and landings. We predict a great and expanding future in the aircraft industry for this fine new material and especially feel that it should find important new applications in the field of thin airfoil structures," states Mr. R. J. Hopper, Del Mar Chief Engineer.

No Other Strengthening Members Required



Largest section is complete wing. Trailing edge (right) is entirely reinforced with STAFAM as indicated by absence of rivets. Second largest section (center right) shows STAFAM core in same trailing edge. Small section (left front) shows STAFAM reinforced trailing edge of upper vertical stabilizer. The remaining, small section is the trailing edge of the lower vertical stabilizer which also has a STAFAM core.

Light weight, cellular plastic Stafam adds strength by bonding all surrounding members—its a super strong unit in addition to supplying extra rigidity. Unlike most foam products, its cell structure is of a nonconnecting type, making it impervious to moisture.

(When ordering Del Mar Engineering information, use a 3x5 inch card.)

Stafam is Simple to Use



Here workers are pouring the entire core of the trailing edge of the Del Mar Delta wing.

Nothing can be simpler than to pour liquid into the cavity of the part that is to be strengthened. STAFAM does away with the joints and labor involved in the conventional methods of strengthening. No more cutting and shaping a core and then painstakingly fitting silver structural members around the core material. In governing time is also reduced. Qualified trained workers can pour liquid into the cavity which is to be strengthened. STAFAM sets into a strong, lightweight case that does the job all by itself.



From left to right: (1) Open pig of Del Mar Delta wing section. (2) Skin of same wing section before core is poured. Note that no interior strengthening members or reinforcements are necessary. (3) Finished assembly. Stronger, lighter, smoother, and more economical product.



Key for testing that section of wing not reinforced with STAFAM.

NOTE

Because of space limitations in this ad information is necessarily incomplete. STAFAM is supplied in hundreds of variations in density, texture, color, strength, insulation and thermal characteristics. For more general information on this truly miracle foam plastic, write for your STAFAM brochure.

Stafoam Can Be Formulated To Produce Astounding Variety of Physical Properties

Only a fraction of its applications have been discovered.

STAFAM is the name applied to all foamed in place plastic materials used by American Latex Products Corporation. It is truly a miracle material! Its applications are so varied, and the results obtained in extreme conditions are so gratifying that it will revolutionize manufacturing methods and procedures. At present STAFAM is produced in three major types: (1) Rigid Alkyl STAFAMs, (2) Rigid Phenolic STAFAMs, (3) Flexible Alkyl STAFAMs.

STAFAM can be formulated to produce an astonishing variety of materials—from substances so dense that it is difficult to distinguish them from metals, through all degrees of density, to materials so porous that they weigh less than 1½ pounds per cubic foot. Besides the rigid types, materials can be formulated that are either flexible or resilient, bouncable to shape slowly, others are difficult to distinguish from natural foam rubber.

Shatter Resistant



Close action through STAFAM filled armor showing formation and lack of cracking may holes made by 30 caliber machine gun bullet.

Light Weight



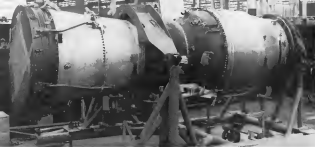
Extreme light weight of this Stafam formulation is shown (left) in relation to weight of cork. The cork sample, and the large sample (right) weigh the same, further emphasizing wide range of densities possible in Stafam formulations.

Rigid Alkyl STAFAM is highly shatter resistant. Structures reinforced with Rigid STAFAM also have extraordinary vibration resistance at working frequencies and amplitudes encountered in many industries.

STAFAM, a registered trademark of American Latex Products Corp., is manufactured under "Latex America" patents owned by The United States Rubber Co., Newark, Ohio. *Registered Trademark of Lockheed Aircraft Corporation.

American Latex Products CORPORATION

3341 West El Segundo Boulevard • Hawthorne, California



FIRST P-4W JET overhauled at Tinker AFB gave shop personnel familiarization needed for future workload with these engines.

Tinker Makes Jet Engines Good As New

Oklahoma City—Operation of the world's largest jet engine overhaul facility at Tinker AFB is one of the big responsibilities of AMC's Oklahoma City Air Materiel Area (OCAMA), commanded by Maj. Gen. W. C. Suster.

Tinker's Engine Overhaul Branch, Maintenance Division, receives its jet engines from worldwide Air Force activities, and Tinker's supply depots ship the overhauled powerplants back to these scattered points over the globe.

The overhaul facility occupies about 25% of a 35-acre windowless, unconditioned building. It handles the Allison J35 turbojets (except for some Allison work on the -25 model) and General Electric's J47-25 and -27. Rates of engines passing through the facility now is about two J35s to one J47.

One Bernardino Air Materiel Area overhauls early J47s. Middletown Air Materiel Area processes Allison J35s and some Pratt & Whitney J40s.

Set for the J57-Tinker's overhaul facility now is preparing to take in

the Pratt & Whitney J57 jet. Tinker probably will be the only base for J57 overhaul. First group of this powerplant will be the J57-21s.

One of three engines already has been accepted and overhauled at Tinker, but making at the same time the required final inspection testing for the facility's shop personnel.

Tinker expects to receive a reasonable volume of the J57s for overhaul beginning in January 1955. This will increase, roughly, with the beginning of overhaul phase-out of the J35s. The number of J57s expected to be received

at the base initially will be about five per month.

In addition for the J57s, shortfalls and uncertainties already have been made in the overhaul shop. The accessory overhaul section is in the process of acquiring new equipment for test and calibration of the J57s. This equipment is for the J57 as an engine accessory, including such items as the main and emergency turbine controls, governors, lube and fuel pumps, etc.

Shop equipment for that engine will include a new parts washer, vertical holes for machining mating surfaces of rotor components, and balancing equipment. Test cell facilities now being installed will meet the new load imposed by the processing of the new engine.

A big maintenance program complete overhauling OCAMA's overhaul job is the



DAMAGED COMPRESSOR illustrates Tinker's job.



OVERHAULED COMPRESSOR ready for shipment.

field maintenance phase (also known as minor repair) for jet engines.

Field Maintenance

This program is intended to accomplish replacement at base level, of relatively short-life, hot-section parts of the jet engine. Such parts include generally, units from the mid-turbine stator (External parts, such as accessories, have always been replaceable in the field.) Field work is followed at base level by an inspection tour.

The program began in 1949, when Air Force overhaul facilities began to fail the full impact of the jet program. Workload became quite heavy and the deployment of jet aircraft to overseas bases put a serious strain on the supply of jet engines. It took some months for engines from the Far East to arrive in the U. S., ending overhaul and return to service. For European units the time was five months. An unusually large number of engines was required, up to 111 the "Pipeline."

► **Workload Responsibility**—In field maintenance, are taken over by OCAMA under AMC decentralization in September 1953. OCAMA's position in the field maintenance phase applies to all USARF subjects all over the world.

The program for field maintenance of jet engines has shown these big advantages:

► An increase of more than 50% in exchange time between overhauls has been achieved in the past three years. This condition is reflected in Tinker's,



STG-60 inspection leads shows J47 compressor rotor after removal from engine.



TOP-GRINDING OPERATION brings compressor blades to proper length.



J35 fuselage takes off from dual engine.



ACIO GIP (showing both for extra combustion chamber).

ROBINSON WIRE TWISTER now in 2 SIZES



NEW! 11 1/2" SLENDER NOSE

For hard work on negative endurances, latitudes and sub-tropicals. Reduced weight only 13 lbs. 11.5 lb. vs. 17.5 lb. in dress low 100. Successive



THE 12" STANDARD

Designed primarily for assembly line safety wiring. Reduced weight only 13 lbs. 12.0 lb. vs. 17.5 lb. in dress low 100. Successive

Split second whirling action safety wires 3 engines in time formerly required for one. 3-tooled . . . pliers . . . cutters . . . wrench. Side cutting, oil tempered heads. Permanent bronze bearing—no oil-maintenance. Jones lock on wire. Can't slip off. Thousands now in use throughout the world. Unrecorded money back guarantee.

RALPH G. ROBINSON CO.

Box 484.

North Sacramento 15, Calif.

MAINTENANCE



CONVEYOR transports long line of turbine shafts and shafts to following unit.



INSPECTION of main economy drive bearing cap before painting.



AFT FRAME is machined on flange fixtures to correct runout.



SETUP for air, oil and fuel test clock on J5 before routing to test cell.

San Francisco and Middletown's materials reduced overhead loads.

- Reduced pipeline quantities of jet engine for a specific engine.
- Cut spare engine requirements on schedule. Spare parts, however, have increased because of the additional replacement parts required at base level for the field maintenance unit.

- Cost factors are inevitable. Do not engine on which time and have too variable field experience, the average major repair cost per engine is about 1/80 that of the average overhaul cost per engine.

Average cost per firing hour with spare engine is about 1/3 that of overhaul engines. This means that



FINAL LINE for J5 (left) and J47 (right), with modification line right.

increased firing hour time is a result of spare engine use being allowed at 1/3 the cost per hour of engines which have not had major repairs.

- Quick action to service is possible with field maintenance—no matter of hours in an emergency, in comparison to months required for complete overhaul, even with precision transportation.
- Little investment in capital equipment, such as engine test, is involved for field maintenance. Manual tools required for the particular engine are repaired units. Welding equipment also is greatly needed, but this type of equipment is portable and not included in the heavy equipment category.
- Engine design changes stemming from field maintenance experience have improved accessibility for field work and replacement.

Other design improvements also have been obtained because information is available faster from field maintenance than it would otherwise be provided from engine overhaul shops.

The J57 engine has not yet been included in the field maintenance program, because not enough field experience has not been gained with this powerplant. However, it is only a matter of a relatively short time before

Tinker's Tools

Tinker's overhaul activity is now running at about half capacity—about 15 engines per day per 5th shift—plus some major repair work for area support. The efficient operation of the overhaul facility, about 150 engines are required to be in process for the 15 engines per day rate.

• **New Long H. Tinker**—it requires about 14 days, on the average, for processing a J5 or a J47 from a repairable to a serviceable state. It is estimated that the processable lag and more powerful J57 will require about twice that time and cost factor, because it has two new sections, their turbine wheels, larger accessories.

With the overhaul facility processing the three engines—J55, J47, and J57—each capacity might be about 35 engines per day on an 8 hr shift.

Tinker conducts a continuous training program for all phases of the engine overhaul activity. This includes cross training in the various sections, as well as specialized training. Also included



FIELD TEST CELL is used for checking jets which have undergone minor repair.



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for your
requirements in

SPECIFICATION VINYL TUBING

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Your purchase and inspection of Specification Grade Vinyl Tubing is simplified when you order from Resin Industries, Inc. because it is completely and accurately tested in our laboratories in accordance with specifications.

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at 1/2 the size and weight of size 15's

... yet at better accuracy and comparable price

Designed and produced by the same engineering team which built the original high precision synchros, this new series is a further step in the line of synchro development.

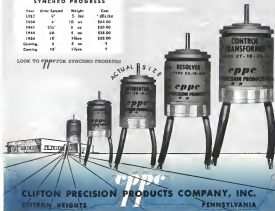
Full engineering information, drawings, electrical characteristics of these and our size 11 and size 15 series are available. We are also producers of miniature A.C. servo and D.C. motors for industry and the government.

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SYNCHRO PROGRESS

Year	Size	Weight	Cost
1947	4"	5 lbs	\$65.00
1954	4"	10 lbs	\$65.00
1961	3 1/2"	8 lbs	\$30.00
1964	3 1/2"	4 lbs	\$35.00
1964	10"	15 lbs	\$35.00
Gearing	5	4 lbs	1
Gearing	10"	15 lbs	1

LOOK TO **cppe** FOR SYNCHRO PROGRESS



■ MAINTENANCE



FIELD REPAIR is done on the F4U's J85 engine by AF mechanics in Japan

in the forward section are cultured personnel concerned with field and major engine, and foreign nationals under the Motor Defense Assistance Program.

► **In One End—Engines** are furnished into the overhaul facility from Troika's local supply. They are taken in at one end of the building, removed from their shipping cradles and installed on the assembly stands.

Accessories and all external parts are removed first and tagged with the engine serial number for bookkeeping and follow-up. These parts need not necessarily go back into the same engine from which they came, whereas all other engine parts, also tagged by engine serial number, must be returned to their same basic engine.

Accessories are mated to an overhaul section in the same building as engine overhaul. However, testing of accessories is conducted in a separate building located close by the main building. The separate accessories test facility is required because of the hazardous conditions usually involved in accessory checks. The building is equipped with explosion-proof equipment.

After necessary tests, the units are delivered to the engine assembly line in complete sets per engine.

► **Cleaning Procedures**—After demagnetizing (one line for J15 one for J67) of the engine components, they are first cleaned for inspection.

Cleaning is done on most parts with degreasing, on others with chemical soak, followed by hot water rinses. Some of the hot-water parts (combustion chambers, transfer lines, needle bearings) are a caustic acid blasting with what is now called. In some cases, an acid dip is used for some hot-section parts which are heavily carbonized.

Monitors and electric horns carry the parts through the washing and dip operations.

After cleaning, most parts are given a complete inspection, visually and occasionally. Checks are made with

20-glo, microscope, vernier caliper and shadowgraph.

Conditioned parts are replaced with new parts from shop stock. "Repairable" tags are hung on "repairable" parts for processing. Repair parts are taken. After repair, parts are again inspected dimensionally and visually.

Parts passing inspection beyond the parts check section to an accumulation point stand at subassembly where they are used to repair or mount parts used them for incorporation into the sub assembly.

Movement of parts, generally, is accomplished with roller conveyors. These are approximately 75 in. of the conveyor installation in the entire branch.

► **Compressor Overhaul**—The compressor offers a good example of the detail involved in the overhaul process. The disks are disassembled from the shaft by loosening the shaft and locking the disks. Blades are then removed from the disks, conditioned units are disassembled and other blades are placed in racks and sent to heat treatment. After heat treatment, blades are reinstalled in their respective branches in the same disks from which they came. Blade tips are then ground to assure conformity with the outside diameter of the compressor rotor assembly.

Which disks plus blades are then reinstalled by statistically balanced and rechecked to form the rotor.

The rotor is spin tested in a vacuum chamber for over-speed condition 10% above maximum operating rpm. Zero checks are used to spot cracks which may have developed in the over-speed test.

The rotor assembly is then statistically balanced to requirements.

Turbine blades and disks are put through a similar routine.

Shaft bearings (blades can be a) are divided up and repaired by weld or by grinding, as per condition.

► **Check Repair**—One of the major jobs on the air frame of the jet engine

Check list

FOR TOP PASSENGER COMFORT!

TECO AIRLINE SEAT

In standard, business and utility types are available in over 1000 configurations.



TECO TRAY

of sturdy, functional "plug-in" type are easy-to-clean, spill-proof, light and attractive.



TECO SEAT COVER

of finest fabrics custom tailored for quick removal and easy dry cleaning.



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In custom choice of finishes are securely attached, snap in place, safe and non-jamming.



The spaciousness, comfort and proper functioning of these checkered items, which most directly affect the comfort of your passengers, are important in creating a lasting good impression. Be sure to frequently inspect your "jetting gear" carefully and economically by replacing with TECO's exclusive new and improved features provide the best of passenger comfort and economy that you can expect today!

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A new key to Accuracy...

IN JET ENGINE, MISSILE AND AIRCRAFT CONTROL LINKAGES

The universal cable shown above is Teleflex—the unique “flexible rack” that is helping to solve vexatious motion problems in the control of jet engines, missiles and aircraft.

Take an example in the jet engine field...

PROBLEM: A highly accurate engine test feedback linkage is required to complete a servo system loop. One end of the system is exposed to a 350°F ambient temperature.

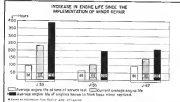
SOLUTION: A special control line was developed, with a ballbed wheel to engage the Teleflex cable. A spring-loading feature allows for a selection of spring loads up to 25 pounds, regulated in their direction, depending on the individual mounting arrangement in system. One system over 100 inches long, with 272" of travel, had only 822 inches of feedback. Under more favorable load and length conditions, similar systems had feedback given in .005, using a similar control line.

Teleflex tubular cordset, routed along contours and around obstructions, guides the cable to remote locations, duplicating the motion at both ends of a system.

DESIGN ENGINEERS—for complete engineering, data request to Teleflex International, 122 S. Main St., Waco, Tex., for your copy of Drawing 430-W.



MAINTENANCE



costs from cracks or distortion in its air ports. This generally requires removal of an inner ring, welding of any cracks, and installation of a new ring by welding. The ring has to be machined to finished diameter.

Aircraft jigs on the air frame fit in alignment by machining of the forward flange.

Combustion chambers and transition liners are generally removable with welding if cracks are within established limits with respect to length, depth and occurrence per unit area. Wagon is generally corrected by reworking.

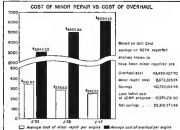
Stator case work generally consists of bleeding down and welding of grooves and machining to match surrounding surfaces.

Alignments are made by bolting together the stator case halves, checking concentricity of stator ports (inboard and forward flange), then machining the mounting flange of the casing in required diameter and balance on the rotor case as major replacement items.

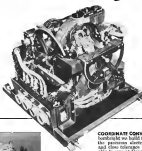
► Together Agave-Roller conveyors bring all parts to a workholding point just ahead of the assembly area. Subassembly work is so arranged that the resulting major units are the forward frame and its components, compressor assembly, midframe, air frame, and the base section.

These major subassemblies are built up on separate lines simultaneously and brought together at the final line—two for the J-35 and one for the J-47. Here, these major subassemblies are brought together with parts such as the combustion chambers, accessories, plating and bearings, to form the complete engine.

Completed engines are taken to the test cells for proving. Engines which pass the test requirements are placed in containers and processed for storage, then shipped to local supply for distribution. Engines which do not meet thrust or other requirements are forwarded to a "bypass line" for determination of deficiency in construction by specially trained personnel. ■ ■ ■



PRECISION PRODUCTION OF ELECTRO-MECHANICAL COMPONENTS IN QUANTITY



COORDINATE CONVERTER, used in the Y-4 bombing, is built for jet bombers. Features the precision electro-mechanical engineering and close tolerance production services available to you at General Mills.



FLIGHT RECORDER maintains continuous flight record of aircraft's altitude, speed, fuel consumption, direction of flight and time. Recorders survive 2,000 G force and 2,000 shock.



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COC can open or close a switch or start a motor at an unattended station 500 miles from the control point, or it can indicate a danger or climatic condition at the end of a runway.

There are varying degrees of COC. Coming under this broad classification is the Hammarlund Multi-Gun® System which provides complete remote control and centering of such quantities as fire, temperature, pressure and voltage, as well as furnishing switching, warning

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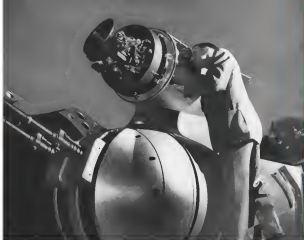
Hammarlund "Flint Control" and Selective Calling Units control the movements of radio-equipped vehicles efficiently and dependably.

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RADAR-DIRECTED tail turret, like the E-47 slings developed by General Electric, provides defense for new jet bombers.

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Avionics Puts 'War' in Warplanes

Avionics makes warplanes out of airplanes. In the form of automatic radar-directed tail turrets, it protects long-range bombers beyond reach of their fighter cover. Avionics provides the seeing eye and computing brain which will enable our bombers to drop their nuclear bombs where they want them, day or night. Avionics gives our interceptors a fire control system which automatically directs them into position and fires their lethal air-to-air missiles, guided to the target by avionics.

In the form of automatic navigation devices, avionics guides bombers, fighters, and transports to their targets. As electronic countermeasures, avionics aims to probe and paralyze enemy missiles and radar. Avionics is also the artificial cord that ties command posts to far-flung aircraft.

Avionics systems are getting bigger, more complex, with a heavier engineering content. This in

turn has brought pressures on industry to make new components—the system building blocks—which are smaller, lighter, more reliable, able to operate at more extreme temperatures, under higher shock.

The avionics industry has expanded tremendously in the past five years to meet the challenge of solving these problems, some of which have been just on the ragged edge of possibility, an expansion that overshadows any other industry. It therefore is not surprising that competition is getting tougher.

However, for an industry that owes its growth to its ability to devise new tools for avionics to perform, the challenge of competition should serve to stimulate the development of new roles for avionics to play, and thereby even greater industry expansion and markets.

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Need a rugged chopper-inverter? See Bristol's Syncoverter Switch*

Bristol Syncoverter Switches are non-pulsed, wide-frequency, low voltage, precision specifications inverters or oscillators, with two SPDT or one DPDT switching action.

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EXCITATION REQUIREMENTS: 0.5 v. or less with a v up to 500 cycles. The Syncoverter Switch will operate normally under sine wave, square wave, pulse, or special wave shape excitation currents, also applicable to plate circuit operation.

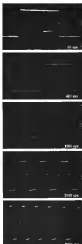
FREQUENCY: Operated as a v-f load or variable frequency, response up to 3500 cycles.

COIL DATA: Available with various coil impedances; also single or double coils for pulse relay applications.

SERVICE LIFE: Life is dependent on operating frequency and loading. Typical ratings: 1000 hours at 400 cycles. Bristol Syncoverter Switches are available with either "make-before-break" or "break-before-make" switching action. They are suitable in the aircraft and communications ranges. Coils are hermetically sealed.

If you have an application requiring a high-quality synchronous oscillator or inverter, write to The Bristol Company, 138 Bristol Rd., Watbury 20, Conn., outlining your requirements. We can help you.

*Pat. Pend.



OSCILLOSCOPE PHOTOGRAPH showing DPDT switching of a typical Syncoverter at various frequencies as shown above.



SCHEMATIC OF Syncoverter and Oscilloscope during the above test.

420

Competition Gets Keener in Avionics

By Philip Klaus

For the first time since 1941, the military avionics industry is opening to a buyer's market. This is a new experience for a large segment of the industry.

Today it is not unusual for 20 to 40 companies to submit proposals where previously only a couple would make bids, AMC officials report. In one recent competition for procurement of marker beacon receivers, 110 bids submitted.

Large companies are now in bidding on jobs at which they formerly turned up their noses. Smaller companies, which previously were just component suppliers, are now after the larger complex systems jobs.

The result is that bidders are sharpening their pencils and quoted prices are coming down, AMC officials say. For instance, a reputable supplier selected in a recent procurement competition bid only \$500 for supplies and time for which AMC previously paid \$1,100.

► **Expanded facilities:** The present state of affairs is primarily due to the tremendous post-World War II expansion of the avionics industry. The expansion has come from three sources.

- **Newly formed companies,** of which there have been literally hundreds, particularly in the component field.
- **Companies seeking to diversify** by moving into the avionics field.
- **Old-line avionics suppliers,** expanding in order to try to maintain or increase their share of the market.

► **Standardized factors—**This situation is unquestionably far from unbalanced by the strictures in the USAF's aircraft program which has put procurement of airborne electronics somewhat in limbo, curtailing this is the increased buying of ground-based avionics for air defense and growing production of guided missiles, which have a very high avionics content.

The importance of avionics cannot be denied out of overall missile applications, this makes exact figures difficult to obtain. However, missile systems should pick up some slack.

With Fiscal '54 only recently completed, and the allocation of Fiscal '55 funds still dead, AMC officials are generally unwilling to say how avionics buying for the coming year will stack up against last year's procurement.

However, in two areas of avionics buying (including approximately \$750 million last year) AMC officials have added a "procurement" to Avionics Week that they would spend at least or slightly more than last year.

► **Civilian industry—**It has developed a very capable avionics industry, from the standpoint of development capability and production capacity,

according to Brig. Gen. Clyde H. Mitchell. Former chief of AMC's Procurement Division, Mitchell is now the Deputy Director/Production. Although AMC welcomes the competition which enables it to buy "more bang for the buck," Gen. Mitchell says it is studying the problem of maintaining a healthy industry, particularly in engineering capacity.

One approach which AMC is exploring is to send some avionics equipment back to its manufacturer for overhaul. An example is the intercepter line control system, manufactured by Hughes Aircraft Co., which got back to Hughes for overhaul and modification. However, the approach cannot be carried too far without jeopardizing AMC's own design capability.

► **Tip for industry—**Companies looking for new avionics fields to conquer might investigate possibilities in the communications area.

"There must be tremendous growth and improvement in ECM," Gen. Mitchell says. However, he points out that the amount of ECM production is relatively small. High-power, high-frequency tubes, such as Klystrons and traveling wave tubes, rate also prove a little field, Mitchell believes.

► **Broader ECM base—**AMC is broadening its base of ECM suppliers, with

more, more companies showing an interest in the field. K. G. Springer told Avionics Week, Springer is deputy chief of communications and photographic branch, at AMC's Aeronautical Equipment Division. This branch buys airborne radar, navigation equipment, communications, IFF (identification friend or foe) and photographic equipment.

Although Springer would like to see even more suppliers in this vitally important field, he cautions that ECM equipment has a high engineering content and requires companies with "unshakable depth."

The signs of increased competition first appeared about eight months ago, Springer reports. In addition to more bidders, and lower prices, he says that manufacturers are looking ways to improve the number of functions which their equipment can perform, but he declined to elaborate. "There's nothing like competition," Springer observed.

► **Trends—**Springer said his division is trying away from buying system components from separate manufacturers, in favor of complete systems contracts. He cited two examples: the AC-119 equipped (high-flo) intercepter system and the ARN-6 radar computer system.

Wherever possible, complete production runs are being made before a new equipment goes into full-scale production. Springer said. Along production testing, a limited number of equipments are produced, then allocated to an operational base where performance can be closely monitored, then quickly discovered and corrected. The technique was first tried, with considerable success, on the new RCA



AERONAUTICAL EQUIPMENT DIVISION, which is being used to test the electronic countermeasures (ECM) system, is a field in which more industry effort is needed, AMC says.

BRISTOL

FINE PRECISION INSTRUMENTS
FOR OVER 60 YEARS

AN/ARC-141B transmitter (Aviacon, Wheat Ridge, CO, p. 44).

AMC is following the same procedure on half a dozen new aircraft and several other communications systems. Spangola says: "Unfortunately we don't have the sales opportunity to employ this technology with ECM, for obvious reasons," he adds.

► **Armament Competition Grows**—There is increased competition also in the fire control systems business. Lt. Col. F. T. Campbell, Chief of the research and development branch says: "For instance, in a recent interceptor fire control system competition, three times as many more bidders as usual requested the op-

portunity to submit proposals.

One of the companies, an old timer in the avionics component and subsystem business now has its eye on more complex systems, and this is typical, Campbell reports. Two companies, originally set up to second aircraft on fire control systems, are now building up engineering capabilities, with the view to building fire control system developments. AMC is not unhappy with this increased interest, and is sure fire control systems, it wishes it had more.

However, modern bomber and interceptor fire control, bombing systems and guidance have become so com-

plex that AMC prefers to let prime contractors with complete system responsibility, and this requires a company with considerable engineering, manufacturing, and management depth.

► **More Private Financing**—More and more companies in the avionics business are using defense contracts to finance system development instead of waiting for government sponsored contracts, Campbell says. Col. E. H. Wilson, chief of the avionics equipment division, believes that the avionics industry might do a lot more development work on its own funds if it wants to live in the business.

There is considerably more component development in the electrical component and subsystem fields than in other avionics areas, Wilson believes. It is not unusual for an instrument manufacturer to anticipate AF needs and work in with a new or improved instrument, developed at his own expense.

► **Look to Tech Reps**—Companies are now to get a jump on competition could make better use of their technical representatives assigned to USAF bases, as a source for new ideas and products. "This is where requirements originate," Wilson points out.

In talking to pilots, flight crews, and base personnel, tech reps can find out what problems need solution, what new equipment is needed to enable the command to carry out its mission more effectively.

► **Added Incentive**—There is considerable incentive for a company to develop new products and systems. AMC's avionic policy is in place until production with the company which developed the equipment, Gen. Mitchell says. Later arrangements may be on a cost basis, but even here the original contractor (with manufacturing experience under his belt) should be in a favorable position.

There are also signs of a possible trend to split out major equipment reliability more specifically in contract specifications. For example, that 90% of the equipment shall operate for 200 hours without an interruption. This has been interpreted for several years as equipment with no need for repair. However, it does provide an incentive for an avionics manufacturer to devote more effort to engineering reliability, and that is what AMC wants.

Most of the new avionics equipment going into service now and in the near future has top-notch performance—when it works, Gen. Mitchell says. The industry's greatest challenge is to make equipment reliability worth its performance. Then, Gen. Mitchell believes, is a past problem for the equipment manufacturer and its component supplier. ■ ■ ■



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ARCHBOLD, PENNSYLVANIA

Gentile Keeps AF Avionics Operational

Durham—This year more than two million avionics lines, ranging from a box of switches to an airborne radio, will make the trip down a mile-long, overhead conveyor belt at Gentile AF Depot on their way into one of four large warehouses on or out to some far flung base. Every day an average of 7,000 shipments leave Gentile at an annual rate approaching \$150 million.

Under command of Col. LeRoy Moler, this depot is responsible for buying all tubes, transistors, capacitors, transformers, relays, and other vital parts and parts needed to put into USAF avionics equipment, both airborne and ground-based, back into operation. The depot also buys all AF test equipment, both electrical and mechanical. Total procurement last year can amount \$100 million.

Airborne radio, navigation, communications, IFF, and radar equipment is bought by Gentile following initial support procurement (first 15 months) which is handled by AMC at Wright-Patterson AF Base. This arrangement is designed to facilitate coordination of the GAFAC equipment with activities in the early phases of an aircraft program.

■ **More Than Supply**—Important as it is to supply avionics, Gentile has other roles to play in the AMC strip-and-repair program.

- Overhaul of airborne radio, radar (except for control), navigation and communications equipment.
- Operate a complete radio crystal-on-recharging facility to handle emergency and special requests.
- Provide a small AF "Bureau of Standards," with portable calibration units and fix other AMC depots and AFMA.
- Conduct specialized portable maintenance facilities.

Approximately 3,200 air mechanics employed at Gentile, of whom approximately 1,200 are in supply, 800 in maintenance, and 100 in procurement.

The balance are supporting functions. ■ **Housekeeper's Dilemma**—Despite the fact that Gentile's warehouses are being used with 154,000 different items, valued at \$340 million, Col. Moler says that the depot's card file system can support the exact location of any item on the list by "99% of the time." A walk through the warehouses (where Col. Moler knows every bit of the complex by first name) provides convincing evidence. Material is stored with an orderliness and neatness to satisfy the most demanding housekeeper.

Gentile is taking some of the bite out of its warehouses with a program to dispose of \$45 million (original cost) worth of surplus and obsolete equipment, some of it dating back prior to World War II. This program, which may save the taxpayer several million,

would occur in value.

Other military and government agencies get first crack at disposable surplus items, followed by educational institutions. Then the surplus goes on public sale, usually via bid, in small lots.

Moler pointed out one group of obsolete generators that stands, since in bad condition, which brought \$100 apiece, against an original cost of \$1,000 more than 10 years ago.

A few short, big bolt kits, are especially priced and sold individually in a small metal-type market on the base. Any equipment such as radar, which would be of storage value to the wing branch, is completely overhauled in a hydraulic press and sold as scrap.

■ **Hiding Down Supplies**—Gentile does not intend to let another large hoard of out-of-use supplies build up to increase warehouse storage costs (which cost \$100 sq. ft. per year) and require base-on-



OVERHAUL SHOPS restore 5,000 equipments to good in new warehouse monthly.



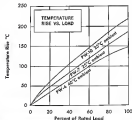
MALE-LONG conveyor speeds thousands of avionics items through Gentile warehouses.

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IRC's new power wire wounds are lower cost per watt than any other power type.

At 4, 7 and 10 watts, they offer savings of several cents each in any application requiring compact, low cost, efficient power resistors. Types PW-4, PW-7 and PW-10 resistors assure safe operation in circuits where stability and low wattage dissipation are needed.



4 WATT
Type PW-4 offers safe operation with ambient temperatures up to 100°C. Fully insulated housing will not burn or support combustion.



7 WATT
Types PW-7 and PW-10 allow safe operation with ambient temperatures up to 175°C.



10 WATT
UNIVERSAL DESIGN AND ASSEMBLY TECHNIQUE PROVIDES LOWER COST PER WATT

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SPECIAL TEST EQUIPMENT, such as this rig for maintaining and



OVERHAULING complex engines, is designed and constructed at Gentile ASD.

Gentile Depot of surplus and obsolete material is also part of its task. One of the department's most important functions is to establish procurement requirements for each of the 124,000 different items for which Gentile has prime responsibility.

Although the department makes use of generally available purchased machine techniques for its supply and requirements activities, it tends to go much faster the world-wide high speed electronic data processing system now in the planning stage at AMC headquarters. Col. Fabick is closely following the work of this group and Gentile may serve as a gatekeeper to guard out obsolete techniques for direct use.

► **Tying Loose Ends**—In use supply operations of this type, which involve a hundred thousand related but undivided items, ensuring has to be up possible loose ends, and that is the role of the Logistics Support Office of the department.

One group in this office has individuals assigned on an audit-type basis to make sure that all electronic and

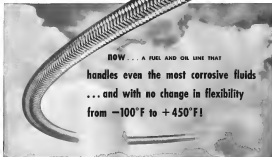
hydraulic ground-support test equipment for that particular system is available. Another group has product specialists on individual aircraft avionics systems, to follow field modifications and retrofit programs, make sure that needed parts and supplies are available.

A third group in this office controls the scheduling of parts needed for overhaul of aircraft equipments in the depot's own shops. A fourth group maintains AF supply documents which call for a variety of material to be needed, frequently in one location at a specific time, for a special project.

Packaging problems occasionally pose a challenge in this business. For example, a valve instrument cannot be shipped by air in an ordinary container but its strong magnetic field disturbs the plane's compass. To provide necessary shielding, engineers clad for air transport are wrapped in an hour of gain-oriented steel foil.

► **Overhaul Time Standards**—AMC is attempting to establish time standards in all its depots for each of its overhaul and maintenance operations. Objective is to enable a depot better to control

first aircraft hose using TEFLON*



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handles even the most corrosive fluids
... and with no change in flexibility
from -100°F to +450°F!

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The most rigorous combination tests devised to evaluate performance prove that here at last are the products designed to eliminate frequent hose replacement.

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**Direct Acting
HYDRAULIC PRESS**



The Verson-Wheelon Ballistic explains the simple operation of the Verson-Wheelon Press and shows examples of the work it performs. Typical specifications are on page 16. It is available on request.

Yes, this Verson-Wheelon Press has a capacity equivalent to a 21,000-ton rubber pad forming press. However, it does a better, more complete forming job than the rubber pad press; yet its cost is only a fraction of that of the conventional press.

The Verson-Wheelon Press illustrated operates at 5,000 psi. Its twin feeding tables are each 50" x 168" to handle long channels for a leading aircraft manufacturer.

If you are now doing or contemplating rubber pad forming, you should consider a Verson-Wheelon Press before you buy. Compare the price and compare the work—it's the best way to convince yourself of the economy of Verson-Wheelon forming. The bulletin described at the left gives full information. Write for your copy, today.

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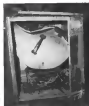
its operation and so he is in a position to determine whether it can take its own program with control facilities and diagnosis.

Time standards, a familiar practice in industry, are difficult to establish for overhaul operations where the men are small and equipment costs back in a study of conditions. When the equipment involved is small, establishing time standards is easy.

How can you predict how long it will take to fix an airplane motor, for instance, when you do not know how long it will take you to find the source of trouble, the most time-consuming element?

Despite the obstacle, Gentile's Maintenance Engineering Directorate and an outside firm of consulting engineers are attempting to work out uniform overhaul time standards for various types of aircraft equipment. Although it may take a couple years, Col. E. J. Hamilton, head of maintenance engineering at Gentile, believes that realistic and useful standards can be set.

The use of standardized trouble-shooting procedures would be one way to achieve greater uniformity in overhaul time between different technicians, Hamilton says. However, he adds that technicians like to follow their own, often creative, fault-finding procedures.



BATTERED BABAR engine shows how some equipment is returned for repair.

► **Damaged and Restored**—When severe equipment comes back from the field, it may be battered and broken.

However, when equipment leaves Maintenance Engineering's shops, its performance will be as good or better than when it originally left the factory, Hamilton says. Performance may be slightly better because of Gentile's job shop equipment which allows technicians an opportunity to tune up the set for optimum performance.

Gentile's engine technicians are organized in groups of 15-18 under a supervisor. Each group specializes in a particular type of equipment, i.e., communications, navigation, engine, weapons, radio, etc. However, trained and technicians readily swap, with a squandering of women are noted and advanced to more complex equipment to give them broader backgrounds and enhance their skills.

An average of 5,000 to 8,000 major components go through overhaul monthly here at Gentile, making it a legitimate operation by any standards. For this reason, the latest production control techniques and visual display charts of job progress are used to assure an orderly operation.

► **Start-Order Capital Facility**—If we don't stock it, we'll make it" might very well be Gentile's motto in radio crystals. The Maintenance Engineering Directorate operates a complete crystal manufacturing and testing facility capable of turning out practically any kind of crystal in 24-48 hours. Some idea of its capacity can be gained from the fact that during the war it turned out 38% of the radio crystals produced in this country, according to W. L. Horton, chief head of Maintenance Engineering.

Talks it a spending way below capacity, need only for post-war sales of

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of shock, vibration, corrosion,
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Intended for use with pilotless, cable and not necessary ground return through mating surfaces, this connector incorporates cooling surfaces at all mating points. W-type Bendix Connectors also incorporate standard Scintilla contact systems in established AN contact arrangements.

Shell components are thick-sectioned high-grade aluminum for maximum strength. All aluminum surfaces are gray finished for protection against corrosion.

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The diagram above illustrates the simplicity of the system. All that's needed is a bottle of air, a Westinghouse Control Valve to regulate the flow of air, and a Westinghouse Cylinder to supply the power. These devices are small and lightweight, and have been proved rugged and dependable in actual aircraft service. You can use them in pressures up to 3,000 psi. They operate perfectly at any temperature from 63° below zero to 360° above!

When you need reliable control of emergency power—for landing gear, brakes, emergency doors, or other operations—look at Westinghouse Pneumatics. They have been used for years in all types of modern aircraft, and they'll do a job for you. Write for specific information.

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AVIATION

gem crystals which are not exclusively included, or by emergency signals where stock is depleted. In these specialized areas, Horton says the crystal sector can produce them cheaper than conventional thermocouples which are set up for large-scale production.

Gentile starts with rough quartz crystal stock, cuts the silicon to an accuracy of 1-14 mils of air, laps them to a finish of .1 or 2 mils each, mounts, calibrates, and tests them. Gentile's crystals normally exhibit a frequency tolerance of 0.0005% over their operating temperature range, Horton reports.

► **Standards.** Because Gentile's Maintenance Engineering Directorate operates a precision Standards Laboratory which serves to calibrate electrical, electronic, and tool and gage measurement devices at all Air depot and AAFSS.

The permanent standards here, which are regularly checked against those at the National Bureau of Standards, are used to calibrate "transfer standards" which are then flown to the various depots to check base standards. Present plans call for a C-47 to be outfitted as a flying standards lab, with shock-mounted fixtures to hold Gentile's transfer standards.

To be sure that calibration has not changed in transit, the transfer standards are checked against the permanent ones when returned to Gentile.

► **Special Test Equipment.** Because of its advanced capabilities, Gentile's Maintenance Engineering group is frequently called upon to make up specialized test vehicles. For example, an interceptor for control system tests was constructed in a cassette shop at day. The shop can be driven alongside the plane mounted the maintenance man in the cockpit to check out and operate water controls while at the same time observing the cockpit radio scope.

Another Gentile product is a maintenance vehicle shop for emergency generators. The shop is mounted in a portable trailer unit which can be installed on a C-119.

► **New House.** By the end of the year, Maintenance Engineering expects to move its shops to a new 200,000 sq. ft. building adjoining another 240,000-sq. ft. warehouse for almost comparable material returned for overhaul. This arrangement will simplify material handling problems.

Gentile's Directorate of Procurement and Production, headed by Maj. M. K. Anderson, expects its Fiscal '55 buying schedule to equal the \$180 million obligated last year. This procurement, made almost exclusively on a firm-price basis, was distributed among more than 1,000 contractors. Approximately 5,000-6,000 contract awards are made annually, Anderson indicates.

■ ■ ■

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Size type, size 1, 1 1/2 in.



Size type, size 1, 1 1/2 in.



Size type, size 1, 1 1/2 in.

Standard Equiflex mountings come in two basic types...the Square Plate and the Circular Cap. Both types are available in three different sizes...size 1 for light loads or small equipment, size 2 for medium loads or medium duty equipment, size 3 for heavy loads or heavy duty equipment.

Equiflex mountings withstand 100 hour salt spray tests, take 15G shocks without damage and will keep equipment captive up to 100G. Extra-damped mountings are available in which each multiple coil spring is shrouded with polyethylene or Teflon tubing.

Equiflex vibration isolators can be supplied to cover load ranges from 16 to 35 lbs.

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Better Management Cuts Personnel

One of Air Materiel Command's greatest resources is people.

A part of the mission statement of the Department of Personnel and Support Operations, Headquarters AMC, states briefly that this department "conducts staff supervisory over all matters pertaining to personnel."

When the average person thinks of this phrase, he thinks, "That is the organization that assigns personnel to the various positions required to accomplish the job of the Air Materiel Command."

But in reality, this is only one facet of its many other responsibilities. In the first place, it refers to a total of 165,000 military and civilian personnel—149,000 military, 5,000 reserve and 1,000 officers, scattered throughout the United States and overseas.

The Commander, AMC, through the Director of Personnel and Support Operations, is vitally interested in the selection and development of each of these individuals as a means of ensuring that the Air Materiel Command receives the maximum productivity from every man and woman employed.

• **Manpower Loss Program**—The major problem with which the Commander is faced, personnel-wise, is how to accomplish the ever-increasing workload of the Command with the continuing decrease of personnel who come under his jurisdiction.

Early in 1953 the Department of Defense found AMC's civilian manpower balance at a number equal to the 170,000 military on the payroll as of Jan. 31, 1953. By June 30, 1953, with troop transfers from Headquarters USAF, that total had soared to 175,700.

Then, through management improvements in depot supply maintenance and support operations, AMC effected a better cut of 10,000 civilian personnel as the last six months of 1953 and made an additional 4,800 cut as the early part of 1954. Further action in this reduction was the reorganization, which eliminated seven subordinate organizations.

This all adds up to an overall personnel reduction since August 1951 of approximately 30,000 civilian personnel, nearly 1,000 military and over 2,000 reserves—this during a period in which USAF was building toward the 157 wing program. Obviously, an AMC program combining of combined action taking an estimated 5/8 below could not have been administered without those management innovations.

• **Efficiency Program**—How did AMC balance this increased workload with the decrease in manpower? For the most

part, management relied on careful planning suggested with the series of personnel programs.

• **Career development**, similar to that which has received widespread interest throughout private industry, was put into effect in 1953 and became effective only in 1954. It will be extended throughout all AMC installations by the end of this year.

This program is designed to increase the efficiency of personnel, and groom selected employees for higher positions of responsibility. This will be accomplished by a system of job rotation, individual approach and training programs to meet the development needs of each individual.

• **Executive development program**, for AMC headquarters and AFM, calls for personnel speakers to address every five personnel at monthly luncheons. This act is to incorporate the program into all relations.

• **Regulation and reward program** has now been decided. Through "Manpower Loss Program," AMC reduced operating costs approximately \$6,100,000 in 1953. More than 6,100 suggestions were accepted and employees were paid \$750,000.

Also in 1953, AMC cut costs by \$1,500,000 as a result of increased emphasis on the control of take-album items. The figure was determined through a study of the take-album system for the five-year period preceding AMC's management plan to control such activities.

Big item has been increased ability to keep qualified personnel. Through overhauling of a number of personnel management processes and tools usage, the Command has been able to reduce its "quit rate" to such an extent that it is now 40% less than the average industrial rate computed for the past six months.

• **Off-duty recreation program** also has been extremely successful during this



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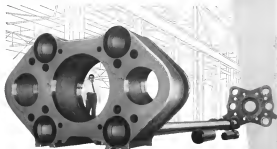
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Completed in schedule since four years of intensive research, development, the world's largest horizontal steel extrusion press is now being installed in the Metal Processing Division of Curtiss-Wright at Buffalo, N. Y.

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period, providing both academic and practical education through classroom instruction as correspondence courses in subjects normally taught in civilian schools and vocational institutions.

During the average week in 1953, more than 4,000 officers and 3,500 air crew were taking part in this program, and 1954 has already shown an increase in the number of people who are participating.

Safe working conditions are basic to almost careers in management. The course has been certified down through the chain of command so that it is now four times what is used in an ABC institution, there is an average industrial plant. The National Safety Council has, for the second consecutive year, recognized this accomplishment by including upon the record of its highest award, the "Award of Honor for Outstanding Good Safety Practices."

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Aircraft engine, maintenance, repair
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• **Contractors:**
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equipment and parts
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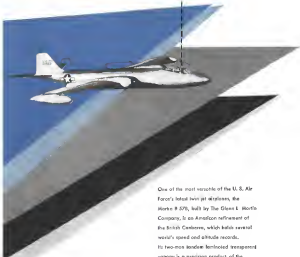
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Air Force Pushes Catalog Program

AMC has established general rules for containing Air Force supply cataloging, supply data records, and bookkeeping entries in the Federal Cataloging Program.

These rules have been distributed within the Air Force on a 20-page Memo Plan which sets forth how the Air Force, during the next several years, will accomplish the conversion with minimum disruption to supply operations.

Through the Memo Plan provisions for conversion, Air Force is striving to attain the fullest possible advantage from the Federal Catalog Program. This program was established under the Defense Cataloging and Standardization Act (Public Law 456), passed by Congress in July 1952. It is a single and uniform catalog program for the Armed Forces, and sets up a common supply language for all items of supply in the military logistical system.

The Federal catalog data eventually will list every item repeatedly purchased, stored, and used by the Army, Navy, and Air Force.

One Naviesman under the new single catalog program, the Army, Navy, and Air Force will use one stock number and description to identify each item of supply item used by any or all of the three services. Such use designed to aid in the interchange of item data promote greater interchangeability, of supply items between the Armed Services, prevent the accumulation of excess property, simplify procurement and to insure other important benefits, in procurement and savings.

The job of supplying the items also will be greatly simplified for industry, by a reduction in the present variety of numberings. Industry manufacturers are obliged to follow when supplying identical items to the military.

First Step—Announcing the Memo Plan in a detailed report on the Air Force's progress thus far in the Federal Cataloging Program. Gen. Banfill, AMC Commander, emphasizes that to day's progress is merely the beginning. He points out that the conversion of the Air Force supply cataloging and records is only part of the Federal program. Actually, the full Federal Program will not become effective in the Air Force until additional logistics cataloging and standardization projects are completed.

The most important such projects now being worked out are the finalization of

• Detailed plans and procedures for full utilization of Federal catalog data to best advantage within the military base

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tion of the Air Force's national management structure. Included among these are such typical functions as budgeting and funding, requirements competition, procurement and production maintenance, quality control, storage and distribution, handling and packaging, screening, and disposal. These plans are being progressively formulated under a master Federal schedule. This schedule is organized according to major Federal supply classes of property. However, some of the plans already have been put into effect.

• **Arrangements with the Air Force, Army, and Navy** for a coordinated schedule of "selective" procurements for specific categories of material. Coordinated arrangements for some of these categories also have been completed.

• **Plans for specific methods** to improve the efficiency and reduce operating costs of the Air Force logistics system, through simplification and standardization of supply data.

Gen. Rowley says the Air Force is entirely in accord with the broad objectives and principles established by the Defense Cataloging and Standardization Act.

"The concept of a single supply language, a single supply classification, stock numbering, and supply catalog system as a tool and service for a single supply system is the basis of the Air Force's logistical operations. The logistical 'bits of life' existing over the past 36 years of the Air Force's national management have convinced us of the concept's soundness," he says.

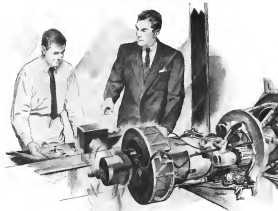
"The Federal program of cataloging therefore requires no abrupt change in our general concepts and approach to supply cataloging and national management," he points out.

"In short," the general statement, "the Air Force is using Federal stock classification data in all applications that are possible prior to actual conversion. These systems are moved toward maximum in such as possible the disrupting effects that inevitable conversion are conversions of records, and the marking of item locations, tags, and stock labels."

• **Changes—Specifically**, the Master Plan provides Air Force institutions with the policy, objectives, and guides for changes from the use of existing cataloging systems and their description data to the use of the new Federal cataloging data.

Under these general rules, AMC already is making substantial progress in using the available data provided through the Federal Cataloging Program.

For example, new items entering the Air Force supply system and items already in the system have been, or are



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The hazard presented by explosive vapors in fuel cells and surrounding areas is eliminated by this positive, positive definite method for safety in flight—a product of Surface Combustion's more than 37 years experience in combustion engineering and atmosphere preparation.

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being described and specified in accordance with the Federal clothing rules, principles, and standards. Approved Federal items names are now used in listing new or revised Air Force drawings, specifications, and similar documents. Federal identification items are being accepted in the catalog unless in specific as they become available, upon assignment by the Department of Defense.

AMC also is assembling catalog data for use in projects of standardization of supply items, and in determining and registering information on item interchangeability, and class substitutes.

This information will be made group research available in the Air Force Supply Catalog and Stock List Publications. In effect, the data thus established on the Air Force and Federal Cataloging Program operations provide a springboard from which to reach the objectives of standardization under the Defense Cataloging and Standardization Act.

► **Property Classes—Under the Mater** First approximately 27 Air Force property classes will first be converted from the present identification and classification codes to those of the 79 Federal Supply Classification Groups—including clothing, fuels and lubricants, and related items on June 18, 1954. Included among these 79 SC Groups are about 18 Federal Supply Classifications.

In carrying out their objectives AMC first will stage Air Force Department responsibilities for material management in the Federal Supply Classification structure.

For example Headquarters AMC already has assigned to the Wilkes Air Force Depot at Sault, Ohio, the responsibility for Federal Supply Class 54, "Clothing and Individual Equipment." Therefore, after June 30 all operational control for connected management of clothing items will be centered at Wilkes, including the clothing stock, final procurement, requirements, competitive distribution, item identification and related functions. The supply responsibility for some items may change in some cases.

Upon the effective conversion date for SC 54, the change of records to use the Federal stock numbers and descriptions will be effected not only at Wilkes AFD, but also at all other Air Force warehouses where supply records are maintained on clothing.

No delay date has yet been established for transferring the remainder of the Air Force supply classes of property to the Federal Cataloging system of supply classifications and coding data, but the task will be accomplished in accordance with a master "conversion" schedule limited down by the Department of Defense. A coordinated Air Force, Army, and Navy program con-



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As in the case of the barrier, Acme may be able to provide life-saving quality at lower finished cost.

These sequence photographs show an F-4 jet pilot, descending a low-level landing at approximately 120 m.p.h. Top photo approaches Runway Over-run Barrier consisting of nylon webbing and steel cable struts at twenty feet of steel sheet and attached to steel reinforcement. Next, webbing is engaged, pulling cable to landing gear height. Third photo, Landing strut pull cable taut, breaking it away from anchorage. Bottom photo is pulling plane (out of photo) to around 260-foot stop.

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version schedule will be submitted to the Congress in April by the Department of Defense. Conversion to specific Federal supply classes will be accomplished simultaneously at approximately 100 Air Force installations throughout the world. Conversion of all items will be spread gradually over the next five to six years.

► **Big job.**—The magnitude of the change-over can be measured by the fact that the average Air Force base is estimated to carry about 60,000 different supply items. With approximately 100 installations in the world, the number of items about 12 million items; records must be changed during the next several years.

All documents carrying a stock number and description must be converted to the Federal number and description data. This applies to bin cards, location files, contracts, stock records, requisitions, equipment tables, maintenance lists, and all number documents.

Approximately 100 Federal Supply Classifications and sub-classifications will exist when conversion is completed. The present Air Force classifications will be discontinued. There are approximately 50 per cent of nearly 200 Air Force classes, which will be the Federal Supply classes.

AMC now is conducting a command-wide educational program to industry-wide learned personnel in the effect and impact of changes involved in the transition to the Federal Cataloging Program. An orientation program is being provided for the benefit of staff officers of all Air Force commands. Training is being extended to Supply technicians and employees at the operating level.

The educational program is being conducted through several different methods: The Air University at Maxwell Air Force Base, Alabama, is including cataloging courses in its curriculum. AMC is holding cataloging seminars and seminars, and distributing information through such media as publications, letters and training guides.

The number of employees assigned to cataloging functions at Headquarters AMC and distribution activities at ANA's and Air Force Depots has been increased. A contractual contractor has been employed to help prepare Federal stock descriptions at the AMC Cataloging Division.

AF Tightens Control On High-Cost Items

AMC is instituting a far-reaching accounting system, designed to tighten control over the procurement of high-cost aircraft supplies and components. Under the system, approximately

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717,000 catalog items in the Air Force inventory are segregated into three different categories:

- 17,000 items, which have a unit cost of \$500 or more. They represent only 2% of the number of cataloged items, but 47% of the total monetary value.
- 460,000 items, which have a unit cost of \$10 to \$499. They represent 25% of the number of cataloged items and 48% of the total monetary value.
- 598,000 items, which have a unit cost of less than \$10. They represent 73% of the total number of cataloged items, but only 35% of the total monetary value.

This program categorizes Air Force supplies and equipment so that related technical and scientific studies are maintained on those items which account for the bulk of dollars in the inventory. Inventory and reporting procedures governing low-cost items are revised.

The plan remedies the deficiencies of the previous system, under which the 30-cent and the \$50,000 items received identical attention from an accounting and reporting standpoint.

AMC points out that the impact of the new category system, which is regarded as one of the most far-reaching management improvement projects ever undertaken by the Air Force, cannot be measured merely in terms of dollar cost savings.

However, AMC emphasizes that tight accounting controls over high-cost items secure procurement of such items on a more selective basis. Reduced control of low-cost items greatly reduces the amount of paperwork. Air Force bases reduce the greater portion of savings derived from the elimination of controls on low-cost items, while the supply reduce considerable savings through the placing of inventory reports on an annual basis. Inventory reporting previously was on a quarterly basis.

AMC says it had been working for a decade on a plan to categorize supplies into groups commensurate with their value. But it added that the practical aspects of the problem had not been far-reaching to simple solution, because of the vast quantities of supplies and complex logistics operations.

Previously every possible management constraint and government accounting requirement group who over-stated AMC's supply system offered helpful suggestions, with regard to the best philosophy of the needed accounting system. But steadily increasing Air Force activities and the rapid increase in inventories magnified the need for managing the supply system with greater efficiency.

Accordingly, as AMC management project—known as the Inventory Categorization Program because it spot-lighted high- and low-cost items—was established.

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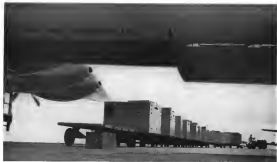
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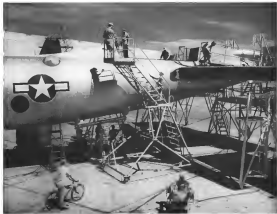
INTERNAL CARGO HANDLING equipment of Douglas C-124 transport speeds movement of supplies through AMC aerial pipeline



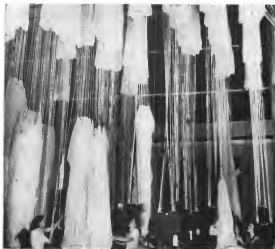
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AUCTIONEER leads down \$57,000 worth of surplus property in cash sale at McClellan AFB. AMC handles DRAP surplus disposal.



VERTICAL FIN has been removed from B-16 as part of SAMANC program to modernize and recondition long-range bomber fleet.



PARACHUTES being taken down and by photo in past 200 ft. size used for cargo drops are repaired at McClellan AFB.



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New Ground Rules To Speed Disposal

USAF, in a drive to clear out "dead wood" from its supply system, has established a three-point program designed to speed up the rotation and sale of large quantities of surplus property.

The program, sponsored by Air Materiel Command, provides:

- New disposal ground rules which greatly expand the number of items which can be cleared out of Air Force inventory. They replace "Project Spring Clean," which has been the backbone of the Air Force's disposal program during the past two years.
- New merchandising methods to broaden the market and speed sales of surplus property and increase the dollar return per unit sold.
- New disposal task groups at Air Force Depots to expedite the disposal program.

The new disposal system establishes like experience for additional aircraft models not included in Project Spring Clean.

Gen. Rowlands, AMC Commander, points out that during the past two years Air Force has been taking aggressive action under Project Spring Clean to dispose of stock on longer needed inventory. Project Spring Clean did not go far enough, and it is expected that the new criteria will produce a substantial increase in the amount of property that will be available for disposal.

In a letter to all Air Force Depots outlining the new disposal policies, Gen. Rowlands has requested that special effort be made to compare the quantity of property to be sold, and that it be moved rapidly out of the Air Force supply system.

Sale of the property will not in providing initially needed workspace for new production items.

• **The Screening Job.** Disposal of excess property is a multiple-stepping process which insures every possibility for other use of the material before it is eventually disposed of as surplus. The property is first made available as excess to other government agencies for possible use in its original capacity. If no other agency can use the property, it is disposed of under specified conditions, as surplus.

New merchandising practices will be introduced in the selling of this property through government surplus sales. This is designed to simplify sales techniques, speed up the turnover of surplus property, increase the dollar return per unit, and reduce the work load in the distribution to bidders and preparation of contracts. Such sales also are expected to make it possible for small



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concerns to participate.

One of the reasons it is desired to make it easy for industrial concerns to purchase surplus property which has a high public after appeal included among such items as clothing, hardware, electrical supplies, and furniture. Consumer items will be sold in small lots of one, two, six, 18, 15, etc., units.

Impressed costation will be used on the government surplus sales to display the items, for the convenience of industrial customers. Showrooms in such form of merchandise will indicate the government's purchase price, and a description of the item.

As to Small Buyers—A period of time will be allowed for inspection of items classified immediately preceding the opening day of bids. Bids will be invited to the opening day to induce bidders to be present on the day of the sale. Some sales will be conducted on Saturdays to encourage maximum attendance of small buyers and permit immediate removal of bids and removal of property sold.

Each government surplus sale will be advertised widely in newspapers, magazines, and radio, so that the public will be fully informed of the dates and places of the sales.

A disposal task group already has been established at Headquarters, AMC, to expedite the disposal program. Such groups are now being established at each Air Force Depot to insure additional drive to the disposal program. Included among the objectives of these groups is the development of a new clearing program which will provide maximum return on items offered for sale, based on current business market practices.

AMC emphasizes that the exact way for a prospective buyer to deal with government surplus sales is to visit or write his nearest Air Force Base. He will be given a tour to complete, showing the prospective buyer's interests, what he wishes to buy, and where he wishes to buy it. No matter which Air Force Base the buyer selects, his name will be entered on the bidder's list in the area he specifies.

New Plan Set Up For Surplus Disposal

The first meeting of the Disposal General Services Administrative Committee, Advisory Committee on Disposal of Surplus Property has resulted in a study endorsement of a proposed legislation plan for disposal of surplus property.

Headquarters, AMC, announces that the plan is expected to be placed in effect soon throughout the Air Force. The committee was requested to

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maintain the Department of Defense and the General Services Administration in seeking solutions to the more difficult aspects of the disposal problem.

The approved manufacturing plan applies to all properties for sale and rules of surplus personal property in the Department of Defense, including contractor inventory and foreign excess. New features of the plan include:

- **Provision for withholding** of surplus property from the commercial market where the sale of such property will adversely affect the commercial market and thus the appropriate industries.
- **Consent of the U. S. Department of Commerce** have made technical recommendations on the situation to the Assistant Secretary of Defense (Supply and Logistics) who will make the final determination.
- **Reporting in advance** of all surplus sales of surplus property within U. S. having separate cost of \$250,000.
- **Establishing a minimum deposit** of 30% of bid price, when a deposit is required.
- **Setting up a procedure** whereby buyers who cannot personally attend an auction can bid on certain items or lots by remote bids.

AMC Teams Guard Quality Control

An Material Command has instituted a modernized and highly effective quality control system that has resulted in Air Force equipment being of higher quality than in former years.

The importance with which this aspect of AMC's activities was regarded was indicated two years ago when a new staff office—Quality Control—was formed from a merger of the separate Quality Control functions in the Directorates of Procurement and Production, Maintenance Engineering and Supply and Services.

• **Contractor's Responsibility**—Today, it is the responsibility of the contractor to maintain control of quality at or above minimum Air Force standards. An Air Force Quality Control representative surveys the contractor's inspection system and verifies the inspections to insure that quality does not drop below Air Force requirements.

The Quality Control representative works with the contractor from the time raw material is received until the final product is completed. This is accomplished by "overriding" type of quality control, using AMC Manual 74-21, "Procurement Quality Control Plan." This plan provides for a systematic appraisal of all contractor aspects related to the quality of the product.

In contrast, during World War II days, as many and items were checked

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to reliable equipment operation. This method involved the use of an inspection force of 14,000 and limited quality assurance to those areas inspected.

In larger plants, the Air Force has several aspects, these include varying from one to 70. Company would plants are divided into three Quality Control Representative, each of whom is responsible for a number of plants. The cost of new inspection equipment amounts by \$1.50 for each \$1,000 worth inspected.

Double Check-Work of the inspection-offered the backbone of the Quality Control System is now inspected by a survey team once or twice a year. The survey team makes facility evaluation surveys to determine the effectiveness and efficiency of the AF Quality Control organization.

The staff office of Headquarters, Air Material Command, has charge of integrating the quality control program in the procurement, supply, and maintenance of material. This office also provides technical assistance and guidance to nation of quality control to other Government agencies. The staff office is subdivided into three offices which handle plans, operations, and quality analysis and three technical districts: Aircraft and Weapons, Equipment, and Technical Methods. These divisions direct the field activities from technical viewpoint.

Technical Methods Division-Scrutinizes of quality control operations over national processes provides necessary equipment, personnel, chemicals, test methods and facilities, is the job of the Technical Methods Division.

The division's Materials and Packaging Branch controls the quality of basic materials such as aluminum, magnesium, and copper alloy, steel, plastic, composites, resins and compounds and methods for corrosion control, preservation and packaging.

It also inspects materials and test methods including chemical analysis, X-ray, and ultrasonic inspection. Another arm of its work includes quality control of fabrication processes. Also the branch has charge of the inspection and accountability of technical data, including maintenance manuals, flighted parts catalogs, except loading data, etc.

The Petroleum and Chemicals Branch oversees the quality aspects of fuels, lubricants, chemicals and related systems. This branch also provides technical direction for the continuous quality control of worldwide systems fuel and lubricating oil supplies and by the Air Force.

Quality control of tools, stores, and other equipment is the responsibility of the Production Engineering Branch. It develops systems for the control and coordination of production receiving and

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Of interest to the Air Force have been Vitro's facilities planning, nuclear power research, titanium photo construction, multi-range timing systems, accelerated data processing, radiation measurement, bomb blast evaluation, and many unusual systems.

Vitro has recently completed new test ranges and engineering facilities at the Air Force Armament Center, Eglin Field, Fla., and is now engaged in the engineering of instrument systems and the operation and maintenance of test ranges.

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blowing techniques to provide inspection adequacy.

Equipment Development: change of quality control for ground and airborne aeromedical equipment is the Equipment Division. Its commodities include photographic, rubber, plastic, textile, and electrical equipment, instruments, ground handling equipment, vehicles and all types aircraft engines.

The Population Branch has responsibility for quality control over acceptance, modification, overhaul, and change of aircraft engines and engine components.

Quality control of equipment ranging from electrical supplies to prefabricated hangars is the work of the Equipment and Accessories Branch.

The Instrument and Photographic Branch is in charge of the quality control of instruments, of reference recording and photographic equipment.

Aircraft and Weapons Division—Quality control of aircraft, guided missiles, aircraft, and electronic equipment is the responsibility of the Aircraft and Weapons Division.

The director's American Branch has quality control of aircraft, the Electronic Branch of electronic equipment, and the Aircraft Branch of an aircraft and guided missiles.

Sampling Speeds Engine Inspection

A statistical sampling plan for aircraft engines, now being tried by the Air Force, is saving millions of dollars annually.

The plan is based upon the long-recognized fact that even 100% inspection involves some small risk that a defective engine will be accepted. Quality Control at Air National Command Headquarters has set up the sampling procedures which require inspection of only a percentage of the engines without increasing the risk of accepting a defective engine.

► **Big Savings**—Is the plan working? Air Force's answer is an unequivocal "Yes." USAF contractors using this plan expect a dollar saving of \$1,515,777 for 5,728 jet engines produced under the production of this statistical sampling plan for aircraft engines. The estimate was based on overall savings of 35,368 man-hours per year on a one-out-of-two basis, 97,060 man-hours on a one-out-of-five basis, and 69,800 man-hours on a one-out-of-10 basis.

Test savings are estimated at \$70,000 per year on a one-out-of-two basis, 944,800 per year on a one-out-of-five basis, and 1,316,000 per year on a one-out-of-10 basis.

Other savings claimed are more due to reduction of engines in process at assembly floor and in parts which need

be replaced in every engine overhaul, such as pistons, plugs, and valves. Also, fewer parts must be replaced due to damage to dissimilarity or unsuitability.

► **Old Way—Until** the Air Force developed a standardized acceptance inspection plan, it had been standard practice to test all newly-built engines as a test cell for about two hours.

The engine then was taken apart and the parts inspected for signs of excessive wear. The contractor would correct any defects and the engine was assembled and run for two more hours. If the final test run showed the engine met all the required performance characteristics, the Air Force inspectors accepted it.

The expense of the motor is apparent. Besides the time consumed, it required test cells to run every engine twice, men needed to operate the cells and inspect the engines, and quantities of fuel.

► **New Way—Basically**, the new plan adopted by Air Force provides for a reduction in the number of engines given a thorough inspection. Also as initial qualification period, during which the manufacturer demonstrates he is producing at a satisfactory quality level, the dismantling and retesting of all the engines is reduced to one-half the number. One quarter or one-fifth based upon the quality level which the engine manufacturer is maintaining.

This quality level is determined from those engines which are dismantled and selected. All engines, however, continue to be completely tested for performance characteristics at least once.

The plan is modified on the 50, 75 or 100% continuous sampling plan, in which the risk is called the "average outgoing quality limit." The Air Force's plan, however, is a triple-level plan providing for adjustments to the 50, 75 or 100% inspection level based upon the manufacturer's established quality level.

The statistical sampling plan for aircraft engines is not a rule of thumb. It is a statistically sound sampling plan which shows the Air Force inspectors whether a manufacturer is producing engines of the desired quality. If the engine is of lower quality, the plan states that the contractor will revert quickly to larger samples or to 100% inspection until the quality improves.

The idea of applying sampling techniques to aircraft engine acceptance in practice was conceived early in 1951 by Air Materiel Command. The concept later was developed and refined by the Air Force in cooperation with Navy's Bureau of Aeronautics. After its meeting of successful efforts, a statistical sampling plan acceptable to both services was agreed upon.

By the end of 1953 the plan was put into operation in an East Coast engine plant on a trial basis. As a result of the



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experience gained in this field, annual improvements were made in the plan and early in 1953 it was published in its present form.

The first jet engine plant was qualified for solid rocket engines under the plan in May 1953. At the present time, two plants are fully qualified and are operating effectively as the plan.

The statistical sampling plan is an example of AMC's efforts to reach these objectives. To obtain more production, better quality and lower cost in the supplies it buys for the Air Force.

AFR 23-2 Defines AMC's Mission

The following states the basic mission, organization and responsibilities of the Air Materiel Command as spelled out in Air Force Regulation 23-2—the authority under which the Command operates.

► **The AMC Mission.** The mission of the Air Materiel Command, consistent with the provisions of Department of Defense directives and specific Headquarters USAF implementing directives, consisting the acquisition, construction, and maintenance of all property, and other actions possible to assure optimum activities covered by separate directives is to:

► Provide overall logistical support for all activities and agencies of the Air Force as well as those additional activities and agencies designated by the Department of Defense which are dependent upon the Department of the Air Force for logistical support, including the Mutual Defense Assistance Program.

► Provide, establish and control adequate, efficient and up-to-date systems of procurement, identification, production, quality control, maintenance, transportation and traffic management, and supply and disposal for all aspects of logistics support for complete aircraft weapon systems, as programmed for, for the Air Force inventory.

► Operate specialized units for the accomplishment of specialized logistic functions as various units and facilities, and provide depot level specialized training for cadre personnel of air depot wings and designated replacement personnel for overseas air depots as prescribed in appropriate directives.

► Concepts and Principles. In performing the above-stated mission, the following principles and concepts will be adhered to:

► There is an ever existing demand upon, and a continuing responsibility throughout, the Air Force for decentralized and decentralized management of resources and operations. This demand guarantees from the logistic functional management of funds, pro-

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economist, production, maintenance, supply, and transportation. In logistics, critical integrated data are essential; the segment for such data specialists and accompanying formal agreements with other Government agencies where procurement is effected for the Air Force, and includes assistance from and coordination with commands such as the Air Research and Development Command. The ready availability of such data in specifications, productivity, drawings (as provided by Air Research and Development Command), production and in-order lead time, actual versus scheduled deliveries, unit costs, status of commitments, and the obligations and expenditures of funds are all prerequisites to sound and economical national management. The overall management responsibility for all related and services acquired for the Air Force is assigned to the Air Materiel Command. This responsibility includes the control, allocation of equipment.

• Carries authority in connection with the above-cited overall management responsibilities and procurement as functions are delegated to other major commands, that is, management of highly technical research and development must occur within the province of Air Force policy and legislative and statutory limitations.

• As a general policy, procurement is a logistic function. The responsibility for acquiring all material and services and by the Air Force is that of the Air Materiel Command, regardless of the assignment or delegation of other procurement and logistic to another service.

• The logistic function throughout the Air Force requires checking, with Air Research and Development Command, any design from the standpoint of producibility and cost of maintenance and modification of material for in-service use, producing material in accordance with qualitative specifications, meeting qualitative requirements, ensuring accurate quality control of material in quantity production and maintenance of material for in-service use. The responsibility for these functions is assigned to the Air Materiel Command.

• Active collaboration, cooperation and coordination must be maintained among representatives of the interdependent development, logistic, and operational agencies (Air Research and Development Command, Air Materiel Command, Air Force Ground Command) and the other major air commands to ensure the maximum effective use of Air Force material, equipment, facilities, and services.

• Any program which would entail an appreciable deviation from approved standards or a deviation in qualitative performance, operational characteristics, production schedules for material items other than aircraft and engines, or op-

erational availability of material in production or service will be considered jointly by the Command, Air Materiel Command, the Command, Air Research and Development Command, the Command of the primary using activity, and the Command, Air Force Ground Command, as appropriate. In those instances where general approval cannot be reached or where the decision is of such importance as to warrant the approval of the Chief of Staff, USAF, recommendations reflecting operational, logistic, and technical considerations will be forwarded to the Chief of Staff, USAF for approval as outlined. Pending a decision on the recommendations, the original status or condition existing prior to the proposal will remain unchanged. Proposed programs to aircraft and engine schedules which involve changes of program quantities, monthly production rates, and model changes will in all cases be submitted to Headquarters USAF for approval. Instructions to maintain implementing changes to USAF approval must be used by Air Materiel Command with approval of such changes is obtained from Headquarters USAF.

• To have a continuing source of technically qualified cadre personnel for an expert group and replacement personnel for departed personnel in events of deaths, injuries and experience is most precise to those types of experience must be provided. The responsibility for implementing this function is assigned to the Air Materiel Command.

• Federal, state, and local standards, policy, plans, and programs in government by the Defense Cataloging and Standardization Act (P.L. 416, 333 Cong., 1951), 1951, implemented by Department of Defense and Department of Air Force districts will be accomplished and maintained according to Air Force assignments and requirements. Uniform item identification, cataloging data, and the maintenance thereof are prerequisites to successful and effective standardization of programs, operations, and material acquisition. Critical items, Air Force existing policies, plans, and programs designed to support and serve the Air Force logistic operations and supply management requirements will be made known according to Air Materiel Command responsibilities, assignments, and commitments.

• Organization. The Air Materiel Command is established in a major air command.

To carry out its mission, functions, and the positions of directors and the policies of the Chief of Staff, USAF, the Air Materiel Command is provided with a headquarters and such units, establishments, facilities, and personnel considered necessary by the Com-

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Responsibilities. The Commander, Air Material Command, will:

- Exercise operational jurisdiction over all units, establishments, facilities, and personnel assigned or attached to the Air Material Command.
- Be responsible to the Chief of Staff, USAF, for performing the following functions:

- (1) Acting as the overall control acquisition and/or procurement and contracting agency for all material required by the Air Force.
- (2) As full head of a procuring activity, exercising staff surveillance over procurement activities of other major air commands to which procurement authority has been delegated.
- (3) Coordinating and cooperating with other services and other Government agencies as the procurement through those services or agencies of Air Force required material. On all material handled by the Air Force but procured by another service under cross-service agreements, the Air Material Command will be the point of contact for the Department of the Air Force as all material incident to procurement functions, except on specifications approved which is the responsibility of Air Research and Development Command.

In addition, Air Material Command will, in coordination with the other services, consummate agreements which will insure that data on other service-procured material is available to the same extent as Air Force directly procured material.

(4) Implementing approved production program, including production scheduling, allocation of production facilities, production control, quality control during manufacturing of material inspection and acceptance, and the actual custody and control of all material procured by the Air Force for which the Department of the Air Force has accepted procurement responsibility, except in those cases where procurement authority has been delegated to another major air command. When procurement authority is delegated or assigned to another major air command, the Commander, Air Material Command will establish the system and procedures applicable to the accomplishment of the above-stated functions by the other major air command.

(5) Maintaining on a current status: Production capabilities under normal and modification conditions; size, cost, production and re-order lead time; general contract administration data as may be required; and providing procurement program data in knowledge of items to be used of Controlled Materials Plan (CMP) allocation (particularly dollar value) and other sensitive equipment items as directed by the Department of

Defense, in accordance with designated program areas. In cooperation with the procuring agencies of the other services, obtaining from, and providing to those services required procurement data on Department of the Air Force or the Department of the Army and Navy loaded material.

(6) The responsibility for acceptance and direct participation on other Service Material Allocation Committee as established by Department of Defense directives is an inherent responsibility incident to the functioning, except when the performance of such functions is a part of primary event authority delegated to another major air command.

(7) Providing plans and developing facilities and resources to meet production requirements, including the maintenance of current and complete location data on all material handled by the Air Force to provide a base for timely and appropriate Air Force logistical planning.

(8) Conducting or supervising factory acceptance testing and depot and modification testing, except when these functions are a part of procurement authority delegated to another major air command. When these functions are a part of the procurement authority delegated to another major air command, the Air Material Command will collaborate in factory acceptance, modification, and service testing.

(9) Providing complete material data on all material and services handled by the Air Force and accepted through Air Material Command either as a contract basis. The data is to be available to include but is not perfectly limited to:

(a) Air Force direct procurement contracts, orders and contracts, including actual versus scheduled deliveries, production and re-order lead time by item or category of items in acceptance, funds status, including obligations, manufacturing and expenditure and appropriate loading data supporting requirements for all additional funding when necessary.

(b) In connection with the procuring activities of the other services, obtaining from and providing to those services procurement data on Department of the Air Force or Department of the Army and Navy loaded material.

(c) Disposition of modification, repair, replacement, and other equipment data, schedules of deliveries, actual versus scheduled deliveries, periods of stock concerns, and funds status, including obligations, commitments, and expenditures.

(7) Providing adequate training support in terms, personnel, and equipment to new units in Government-furnished sensitive equipment (GFE) because available and not installed in the

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air frame and/or other major and minor (10) Maintaining a system which will accurately reflect the current status of all applicable assets and which will allow appropriate recognition thereof in developing requirements involving government action.

(11) Scheduling applicable assets into flight and/or operational facilities for passage input and return to the Air Force logistics system as necessary for programmed requirements, giving consideration to the full utilization of available capabilities (including and/or local civilian economy resources for contractual maintenance.

(12) Performing transportation and traffic management functions for the movement of material for which (Air Materiel Command has responsibility and delegated operational transportation and traffic management functions for the Air Force.

(13) Computing requirements for all material acquired by the Air Force based upon program data provided by, as is directed by, the Chief of Staff, USAF, to include all requirements for MAF or other assistance programs for which the Air Force has Department of Defense delegated responsibility.

(14) Providing the required detailed substantiating and backup data, including the verification of the mathematical accuracy of the requirements, computations for budget estimates and proposed procurement programs for all material for which preparation responsibility has been, or is delegated by the Chief of Staff, USAF.

(15) Providing budget estimates and requesting appropriated funds for a particular fiscal year sufficiently in advance of the approved hearing program date to take into full consideration the total budget (line item) required to procure as air frame, engine, or any other of equipment.

(16) Preparing personnel and facilities requirements plans, programs, and budget estimates to coordinate them with in accordance with personnel policies and directives.

(17) Implementing Headquarters USAF directed material and logistical programs and projects and periodically advising the Chief of Staff, USAF, of status and progress.

(18) Establishing and implementing a procedure covering all the Air Materiel Command aircraft systems to make available to the Air Force at programmed dates complete aircraft system status (including personnel, guidance and control, armament and required test, ground handling, maintenance, and support equipment).

(19) Maintaining a program and a system of uniform form identification cataloging systems essential for the effective support and accomplishment of the Air Force logistical and supply manage-

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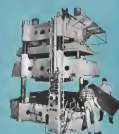


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(24) Compiling, processing, publishing, and distributing Air Force-wide supply catalog data. Participating with industry, other major air commands, the Departments of the Army and Navy, and other appropriate agencies in the collection and exchange of information as matters pertaining to cataloging. Providing a uniform supply cataloging organization system, including operations, and data in accordance with the concepts and principles for the successful accomplishment of the multiple functions and objectives of supply management.

(25) Determining interdependency and interrelationship in collaboration with the using commands and engineering in case agencies (ARDEC) for resources utilization and interconnection of Air Force materiel resources. This includes adaptation of design to economical quantity manufacture and the choice and improvement of manufacturing process evident through the development of the military capabilities of the materiel and not changed. Interchangeability of parts and modification of fabrication processes are in the category.

(26) Maintaining technical direction and staff cooperation in accordance with Air Research and Development Command approved design criteria over the Air Force packaging and methods handling, progress, establishing and implementing design prevention programs.

(27) Determining and/or recommending approval for the authorization of the type, quantity, and/or basis of use of equipment and individual equipment required by Air Force activities, establishing and maintaining a system for authorizing such equipment for Air Force activities, including design prepared by the major six commands to the Materiel Component Authorization List (MEAL), and Item Priority Record and Equipment Authorization List (ITEMAL), and their Allowance List (UAL), and Item Allowance List (IAL), with recommendations for approval (disapproval), or alternate action to Headquarters USAF. Cataloging, publishing, and distributing Air Force-wide Requirement Component Units (RCU's) pertaining individual tool kits and sets of equipment for a specific type of functional operation, such as joint force, maintenance, and so forth. Item and equipment coding. Air Force-wide Testable Tables of Equipment (TTE's) to report new type of pilot and pilotless aircraft.

(28) Providing Wright Air Development Center through ARDEC with Buyer's Guide Series of materiel on which procurement is to be effected for verification of specifications prior to preparation of Purchase Request and for Military Interdepartmental Purchase Request.

(29) Utilizing data reported and available for its acquisition, together with data submitted by other major air commands, and compiling and editing, from a technical standpoint, the USAF Logistics and Planning Manual.

(30) Maintaining continuing effort to obtain the maximum effectiveness from all resources available to the Air Force, including the establishment of a system which will reflect accurately the current status of materiel resources within and available for the Air Force logistic system.

(31) Directing and performing the Air Force depot level of supply operations, including the acquisition, receipt, distribution, storage, issue, and stock control of Air Force materiel, including Army, Navy, or other Federal agency materiel (aircraft) for which the Air Force has storage and issue responsibility, within the zone of the interior, and providing supply logistical direction and maintenance, as required.

(32) Providing depot level maintenance within the zone of activity of Air Force materiel, providing for depot level maintenance within the zone of interest on materiel possessed by other departments for the Air Force or by the Air Force for other departments in accordance with interdepartmental agreements.

(33) Compiling, processing, and/or publishing, and distributing Air Force-wide standard methods and standards in technical publications for the maintenance and operation of all materiel in the Air Force system. This includes a management requirement for a cooperation and coordination in repair performance, to necessary, with other major air commands, such as Air Research and Development Command, other services and Government agencies performing a development, supply, and/or service function for the Air Force to ensure the availability of specifications, drawings, and other data required.

(34) Administering a recall or contract regarding the Unification of Parts system to provide better and more expeditious support to the Air Force. This will be done in coordination with Air Research and Development Command and other major air commands as required.

(35) Providing installation engineering, for, and the installation of, fixed force, maintenance, and so forth, materiel and equipment, including Air Training Command when reported, in the training of installation-engineering, installation, and maintenance personnel for such activities.

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• Associate Contractor-A Prime Contractor to the Air Force for the development or production of items or equipment meeting specifications prepared by another contractor and approved by the Air Force.

• Policy. The following Air Force policies are stated for the guidance of all agencies and organizations.

• Owing to the increased technical complexity of present day aircraft and equipment, the increasing necessity of achieving complete and complete of the various agencies within a Weapon System, and the ever present necessity for expedition, safety, and economic response from the development stage to the production phase, the normal practice for the Air Force will be to accomplish Weapon System Development through Weapon System Contractors.

• Since the advantages and disadvantages of various different methods of procuring development and production vary with the type of equipment, Major Subsystem and components considered, the normal practice for the Air Force will be to procure the development and production of a Weapon System as shown in attachments.

• Sufficient control will be established and maintained by the Air Force to insure that:

(1) A vigorous and healthy equipment industry will be maintained.

(2) A proper industrial base in the equipment industry is maintained to provide for rapid production expansion in the event of mobilization.

(3) Only reasonable profits and costs are allowed.

(4) Government accepted standards are used to the maximum practicable extent.

• Owing to the large development work which must precede Weapon System production, a continuing program of research and development will be maintained by the Air Force, independent of Weapon System Development, in order to assure orderly, balanced, and continuing progress in studies, research and Major Subsystem, component equipment and their item development.

Responsibilities

a. Air Materiel Command will perform Weapon System Development and will select contractors for production.
b. Air Research and Development Command will maintain close liaison with all engineering aspects of Weapon System Development.
c. Air Materiel Command will maintain close surveillance of producibility,

producibility, maintainability, and other logistic factors during the progress of Weapon System Development and during production.

Procedures

• The Air Materiel Command and the Air Research and Development Command will prepare development and production of Weapon System as described herein. Deviations from this procurement procedure may be made if AMC and ARDC jointly determine that a good and sufficient reason exists for such deviations, after conducting a review of the specific conditions in the particular case, such as unique technical aspects of the system, the time schedule involved, the status of Air Force development, and the capacity and capability of the particular contractor being considered.

• Air Research and Development Command will monitor development of Major Subsystems, insuring that development of their internal parts is expedient when GPAT is standard Air Force equipment is available, in order development and will be satisfactory for use without compromising effectiveness of the Weapon System.

• Air Research and Development Command will approve the design, qualification test, and installation data for all items.

• Air Materiel Command will include provision in contracts with Weapon System Contractors providing for Air Force approval of equipment development and production which as is exemplified directly by the Weapon System Contractor under the procedure of category 1 of attachment. In assistance for the development and production of Weapon Systems, provision will also be included for Air Force approval of subcontractors for equipment produced by the procedure of category 1 of attachment. In the above-stated approvals consideration will be given, but not be limited, to:

(Primary Responsibility)

- (1) Selection of equipment ARDC
- (2) Selection or approval of specifications ARDC
- (3) Standardization of equipment ARDC
- (4) Qualification testing of all items prior to production delivery ARDC
- (5) Approval of subcontract ARDC
- (6) Type of subcontract ARDC
- (7) Price and profit ARDC
- (8) Drawings and bearing rights for equipment ARDC
- (9) Quantity of equipment as manufactured ARDC
- (10) Timely delivery of test and test data ARDC
- (11) Timely delivery of production data ARDC

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☐ **Check contents and locations of first-aid kits.** Be sure they're adequate and up to date. Here, again, your

CD Director can help. He'll advise you on supplies needed for injuries due to heat, radiation, etc.

☐ **Encourage personnel to attend Red Cross First-Aid Training Courses.** They may save your life.

☐ **Encourage your staff and your community** to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads and official CD films or literature that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good community relations—and no greater way of helping America.

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Boeing officials admit the landing gear trouble, still under enthusiastic over the new aircraft. It already had passed the 370 mph turbulence test causing speed.

Worried that its ground troubles have a prelude on the last U-5 jet test port, one Boeing spokesman even remarked, "We could make figure out a way to have it top in the air."

• **Timing Cast Phenomenon**—There released no details on its production order for the Boeing jet bomber. But the contract was expected to cover cost of testing for production plus reference number of aircraft could be built with the same left over after setting up the assembly line. In the case of the B-77A, this turned out to be 10 aircraft.

Boeing executives also were wondering just what kinds the USAF contract would allow them in accepting orders from U-5 refueling jet test ports. For there was no doubt that the Air Force order gave Boeing another big boost in the new jet engine order—despite a simultaneous USAF assurance that its design competition for a jet engine would continue.

Must mean break in the situation come in a paper delivered at the insti-

tute of the Aeronautical Sciences meeting on October 1967 at transportation here last week by John E. Stuart, project engineer of Boeing's production design team. In his "Shipping Large Jet Airplanes"—WJC.

USAF to Show B-52 At Dayton Air Show

Boeing's long-range B-52 jet bomber will be demonstrated to the public for the first time at the National Aircraft Show in Dayton, Ohio, Sept. 4-5 and 6. In addition to a static display, USAF crews will stage a fly-by of the B-52 each day of the show.

Other daily events at Cox Municipal Airport, Dayton, will include:

- Arrival of 12 B-52 jet bombers on training flights from England.

- Intercourse of B-52 bomber in three F-4 Starfighter and a C-130 tactical jet plane.

The interservice plan will demonstrate and demonstrate how each weapon can be used by the Air Defense Command.

- Precision flying demonstration by USAF Thunderbirds and Navy Blue Angels.

Event pilots, led by Maj. Ted

Hoar, Keesler jet, will open each performance, with some bonus drive into the crowd.

Navy and Marine aviation programs were not complete last week. The test schedule calls for fly-by of F-3H, F-7H and F-3H fighters, a demonstration of H-1H helicopter and an aerial refueling exhibition in A-1H and F-1H. There is a possibility that the Navy's application of helicopter in air control in its own major plan, performance will be demonstrated.

The Army plan to show how light-planes are utilized by troops in the field and last year's popular helicopter square dance will be repeated.

Major trophy events will be:

- Sept. 4, Boeing Trophy race, speed and time Edwards AFB, Calif., to Denver.

- Sept. 5, Allison Trophy event for accurate and interception of B-23 bombers, General Electric Trophy race 100 kilometers.

- Sept. 6, Thompson Trophy race, 100 kilometers.

In all, 175 USAF planes will take part in the show. North 130 commercial exhibits will be set up in separate hangars to display latest equipment of aviation industry firms.

Event pilots, led by Maj. Ted



Lockheed Rolls Out Turboprop YC-130

Flight tests are expected to begin soon on the Lockheed turboprop YC-130 transport for USAF at Edwards AFB, following test out of Roswell, Calif. (Quonset production of C-130A is assigned to Lockheed's Marietta, Ga., plant. Allison T400s each delivering 3,700 hp, two three-blade Curtiss propellers spin 132 ft. will carry up to 30 men loads. Low-wing design has a flat at truck bed level, apron loading permits forward loading. Windows now clearly indicate forward load streamlines before they curve back over the cargo. Dual headlights are used.

ACC Backs Doolittle Airport Proposals

An Coordinating Committee has approved recommendations of the Doolittle Airport Commission on airport safety with the exception of a proposal to relocate airports.

Major recommendations:

- Expand Doolittle airport. Lighter aircraft in the neighborhood of federal air should be given to runways and their protective extensions. Participants, ACC said, would be concentrated upon types of aircraft aircraft with one type of aircraft.

- Support expansion, airport development. New airports will be needed and present airports must be improved. State, county and municipal governments should be prepared to increase their proper share of the expense.

- Maintain positive air traffic control. Customs air traffic control zones in areas of high air traffic density should be made subject to special regulations to insure that all aircraft within the zone are under positive control at all times, regardless of weather.

ACC says this subject has been under discussion within the committee but that Civil Aeronautics Administration has lacked funds, personnel and other basic equipment to carry out the program at the present time.

- Rule clearing and uncovering subways. Present straight air terminal approach patterns are considered unsatisfactory, but the insurance, college and universities under which aircraft are permitted to circle in numerous areas the amount in improved terminal area should be made.

Commerce Department concerned with the recommendations in the extent of continuing existing and making air-traffic, maximum where safety devices.

- Extend use of single runway system. New airports should stage a single, or parallel runway design. This should be adequate except under strong wind conditions, in which case a shorter runway at 90 deg. to the main one may be required.

Present airports should plan to develop the dominant runway at the expense of those less used. Airport expansion should be achieved through an additional parallel runway. Commerce Department agreed with the recommendations provided a single runway will yield 95% coverage with a 15-mph crosswind component.

Other recommendations were concerned with airport safety, such as and not deal with controversial subjects.

Commerce Department and CAB did not concur in the recommendation to authorize airports, since the subject was not in the recommendations can be

addressed under existing authority. Objectives sought by the commission.

- To make certain that all major airports would conform to defined minimum safety standards.

- To prevent major airports from being substantially closed or abandoned.

The review procedures assigned responsibility for carrying out the recommendations. Most of the changes can be made without additional legislation with the notable exception of securing federal funds for airport aid.

The ACC group reviewing the Doolittle commission was composed of: Joseph D. Roth, CAA, chairman; Dr. Henry Harvey, CAA; William B. Becker, Air Transport Association; Capt. E. L. Doolittle, Navy; Col. Clifford Doolittle, Air Force; and Robert Fossano, CAA.

During the past World War II flight they dropped on for several years, the "chosen instrument" was aggressively advanced by Pan American and supported by United Air Lines. All other carriers strong he opposed it.

Thye to Fight "Chosen" International Airline

An Administration supporter, Sen. Edward Tyron, has given a "warning" that he will fight establishment of a "chosen instrument" for international aviation, especially being proposed on grounds of economy by "certain people in high positions of government."

"This policy has been rejected upon numerous occasions in the past by the executive and the legislative branches of our government," Sen. Minnesota says in a floor speech. "Many assumed that it was a dead one."

- ACC Policy—The following statement from Air Coordinating Committee's report on civil air policy, he noted, states that "The new design for the chosen instrument policy will be based upon the grounds of economy."

"National interest factors require that many international routes be maintained despite adverse economic conditions in this area should we

oppose the necessity of avoiding or eliminating unnecessary duplication of services between U.S. carriers."

Tyron said he is concerned specifically with possible domination of Northwest Airlines' Orient route, in which case "all U.S. flag carrier operators in the Pacific would be monopolized by Pan American Airways."

- **Domestic Competition**—The chosen instrument policy, Tye predicted, "would serve to destroy free competition in a vital segment of our economy."

That notion of free competition has brought out the heart of many's argument, and is a basic part of our nation's success. We must not destroy that which has contributed so much to the productivity and progress economy which we enjoy.

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Tom Braniff Crash Blamed on Wing Ice

Rapid accumulation of wing ice on the crash Jan. 10 of a Braniff 707 jetliner that killed 12 persons, including Thomas Braniff, founder and president of Braniff Airways (Aviation Week Jan. 18, p. 34).

Pilot's failure to recognize himself with the postcrash weather forecast was cited as a contributing factor in the Civil Aeronautics Board accident investigation report.

The plane, owned by the Union Pacific Co. of Shreveport, La., crashed approximately 10 mi. north of Shreveport, La., while carrying a heavy party.

ACC says this subject has been under discussion within the committee but that Civil Aeronautics Administration has lacked funds, personnel and other basic equipment to carry out the program at the present time.

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F-86D SABRE workload program already has begun and a similar plan for...



F-94C STARFIRE modification is scheduled to get under way early next month

USAF to Modify F-86D, F-94C

Sabres are moving onto lines for airframe, engine and fire control changes; Starfires to begin Sept. 1.

Los Angeles—U. S. Air Force has started a major modification program to improve both of its Delaware Command's three all-weather interceptors: North American Aviation's F-86D Sabre and Lockheed Aircraft Corp.'s F-94C Starfire (see p. 53).

The program will include airframe, engine and fire control changes.

"Project Palmetto" (AVIATION WEEK Aug. 19, p. 11) already is under way with F-86Ds moving into a modification line at McClellan AFB, Sacramento, Calif., and at the NAA facility at Toccoa, Ga.

F-94C modification known as project "Hop-Ups," is scheduled to get under way about Sept. 1.

No further program is contemplated for the third ADC all-weather interceptor, Northrop Aircraft's F-50D that is currently completed a major modification.

Side by Side.—The program will concentrate for 18 months with all F-86Ds and F-94Cs have been modified to meet the new assignment. This was used a half Sabre was used not to modify the aircraft as much as possible without unduly changing the aircraft's performance by getting too many out of service at once.

More than half of the aircraft will be modified in side-by-side modification lines at Air Materiel Command's base at McClellan, the Sacramento Air Materiel Area, Lockheed and North American units will modify more than 100 of these units each.

F-86D Changes.—Completeness of the overhaul may be pulled into the manner in which each F-86D will be turned apart during the program. Its internal structure and wing will be overhauled at Sacramento or Fresno. The airframe will be sent to NAA's high-speed plant, the E-4 fire control section to Hughes Aircraft, and the autopilot to Ray, Tex.

There are among the F-86D changes:

- Modification of fire control system to improve its performance. Details of this are classified.
- Installation of radar type system to record altitudes data during flight.
- Modification of flight control system. This is largely a change in the cockpit's control system. Intended to give the pilot a stick more resistant than will vary with stability turn changes of carrier speed, the modification is "variable drag" and system. It is a mechanical change.

- Installation of drag chute in the tail, expected to reduce landing air as much as 40%.
- A 16-Hz, magnet type drive will be stored in a compartment below the radar and above the cockpit.
- Modification of low altitude. Details of this change also are classified.
- Modification of the F-86D engine to the J47-CF-17B configuration. This includes hot track station system for quality afterburner lighting as well as control changes designed to cut maintenance problems.

F-94C Modifications.—The Lockheed F-94C fire control system will be modified during the program, but again recently prohibits disclosure of details. Another of the changes scheduled for the Starfire will bring an enlarged cockpit.

A number of F-94C pilots in the past have complained that the Starfire cockpit was too small for side vision. Later, Lockheed designed a cockpit only to be better equipped, which Lockheed Aircraft Service unit will have some advantages over older type seats. The new seats provide increased space for both pilot and radar observer, plus a greater design strength for high-speed operation.

A guaranteed catapult system will ensure successful ejection.

The seat includes an automatic right-left selector, that spins the seat back and forward, houses automatically after ejection.

A flight instructor is being installed in the F-94C to protect the radar observer after the engine is jammed prior to landing. The new seat also includes a heavy steel bar across the head rest to act as a man to break through the cockpit glass if the pilot must eject with his canopy down. Following trials added to the new seat assure that this will be clear of the aircraft upon final release. This new seat includes and also provides protection of the vertical stabilizer after ejection.

In another change the pilot's seat has been made adjustable both fore and aft as well as in height.

Another modification of the modification program has been a major test of AMCA's policy of placing responsibility for prime aircraft at the Air Materiel Area level. The Sacramento Air Materiel Area will process some 500 aircraft through its maintenance lines during fiscal 1955, including those of "Palmetto" and "Hop-Ups."

The Sacramento AMCA worked with Wright Air Development Center, Dayton, Ohio, and the Air Materiel Area. The program is to be completed and other operations now under way to work out a program to modernize the new aircraft and bring them up to the desired configuration.

"One of the new modifications," says Col. Arthur C. Perry, director of

maintenance at the Sacramento AMIA, "was to work out a schedule acceptable to the Air Materiel Command as the number of planes which they could receive."

Close Support.—In order to overhaul the aircraft in the minimum time, Sacramento worked out a close support with the other Air Materiel Areas involved in the program, engines at the Oklahoma City AMIA, autopilot systems at McClellan, AMIA, and fire control at Warner Robins.

In direct support of the maintenance director at McClellan on a "project" of the F-86D modification through its aircraft base before "Project Palmetto" was started. A team

composed of shop personnel, technical engineers and production control experts have the plane apart and compared a list of all jobs that could conceivably come up during the overhaul.

The data then was used in planning the overhaul line that would modify the aircraft.

Aircraft Holds Lead As Biggest Employer

Aircraft industry continued to lead the automobile industry during April as the nation's largest manufacturing employer despite a drop of 6,500 workers from March employment statistics.

(Aviation Week, July 5, p. 15). During the same period, the automobile industry lost 15,000.

April statistics from Department of Labor's Bureau of Labor Statistics show:

- Aircraft and parts industry employed 536,636 persons, compared with 755,100 in automobile manufacturing.
- Average weekly earnings for aircraft and parts production workers was \$53.41, compared with \$53.33 for auto workers.
- Weekly hours average was 40.5 for the aircraft and parts industry, compared with 40.6 for the automobile industry, average hourly earnings were \$2.50 in the aircraft industry and \$2.17 in automobile work.



F9F-9 Tiger

• German takes wraps off supersonic Navy fighter.

• New jet has 'Coke bottle' fuselage to reduce drag.

Patent River, N. Y.—German Aircraft Engineering Corp. studied down into its long record book of experimental trials and pulled out a new one, the supersonic F9F-9 Tiger, designed as a jet fighter for the Navy (AVIATION WEEK Aug. 9, p. 11).

In Germany's first public showing of a new fighter since 1947 (the FVZ 2), test pilot H. C. (Coke) Meyer demonstrated the great speed of the pioneering, whole plane as a series of lightning low altitude runs past a crowd of Navy and company officials, the press and news cameras.

Afterwards Meyer commented: "The plane held in its field back for three months. But we had better improve, and the jets there with no effort at all."

No Old One.—Although the Tiger carries the designation of the elderly F9F series, it is a completely new design, comparable as a descendant of the rough-and-ready Panther and Cougar. Its indicated fuselage lines are an aerodynamic challenge to reduce drag



and speed. About all Germans will say is that the fuselage is best described by its nickname of "Coke bottle."

Harmonized and is currently shown and is the all-time top with world-class elevators, reported to be operated only when gear and flaps are down. It is in mounted on the fuselage in the side position, North American Aviation in the F-100 as the source in stability problems of pathway at high Mach numbers.

Powplant of the F9F-9 is a Wright Aircraft 10,000-hp turbojet rated at better than 7,200 hp. Although it will be accompanied in production models but has not been installed set on the prototype.

Missile Armament.—The new Tiger will have modern armament, six Grumman, including, air-to-air and air-to-ground missiles.

Wings are swept to about the same

degree as the Cougar. They are no broader than, and the entire upper surface is machined into a single curve of aluminum alloy.

Only a small portion near the wing tip is left unplaned for storage.

Leading edge attacks into the fuselage, giving it the narrow head and appearance that characterized the first jet-increased gear designed by Grumman for its F-101 back in 1951.

Grumman has a \$40 million contract covering the prototype development and production of the airplane. Production of the Tiger is under way now.

The Tiger's attitude is summed up by Rear Adm. Apollo Soanick, chief of the Bureau of Aeronautics, Navy Research. "Once again, Grumman has come through when we needed it. We use its most good and better engine than Grumman has ever given us before."

—DAA

An important message to Engineers

from

I. Nevin Palley

Vice President—Engineering

TEMCO AIRCRAFT CORPORATION



Your future, like mine, depends not only upon your professional abilities, but upon your choice of the company where you will exercise them.

There is one word—familiar to engineers—that perfectly describes our organization and

its future: **dynamic**. TEMCO's growth has been remarkable. More important, it has been sound, for it is based on experienced personnel and alert, aggressive management. Here are three growth graphs to quickly illustrate for you what this company's history has been and what its future promises:



VOLUME OF SALES



PLANT AREA GROWTH



WAGES AND SALARIES

A company this dynamic simply doesn't develop kind entry positions. We are expanding. We are growing. The people who are here now and who join us in the next few years will be our group leaders and department heads ten years from today.

We need highly skilled technical specialists at high level positions in these fields:

Staff Engineers • Weapons Systems Analysis and Design • Stress Analysis • Electronics—Electro-mechanical design, circuit design, package design • Dynamics Analysis • Aerodynamics—Stability and Control

Open positions open for liaison engineers, designers, and inspectors.

If you feel qualified for one of these jobs, and want to join an expanding company that offers you a real opportunity to develop your full professional abilities, write us for details about these openings.

We'll send qualified applicants details about the job, the company, and living conditions in this alert Southwestern community. I can tell you this much right now—and we think it is highly significant—the engineers who work for TEMCO have this in common: We like our work and feel that our future is unlimited.

Photo by E. J. Barlow, Jr.
Engineering Personnel Supervisor



CAA Preparing Jet Liner Rules

Lee tells IAS that changes and standards must be developed as turbine transport facts are established.

Civil Aeronautics Administration will start and successfully solve turbine-powered transport problems as they arise, CAA Administrator Fred B. Lee told the Institute of the Aeronautical Sciences meeting held at Seattle last week.

"The aeronautical community will have been noteworthy," he said, "a direct result of active cooperation between industry and government." American industry, coupled with cooperation on most and solution on problems developed and modified in the fundamental engineering principles and from an established," he added. "Standards must exist in building to and improving the safety record but they must not hamper progress."

Some of the decisions on certification cannot be long delayed, since upon them will depend fundamental aspects of the aircraft design itself: the location of the propellers, the size of the fuselage, how much stability, and payload; fuel use, range, climbability, and maneuverability.

Major points impacting "word only" and "rule" decisions," he told IAS are:

- **Powerplants:** Because of the tremendous amount of turbine engine thrust

re the existing parts of turbojet and turbofan engines in operating speeds, it can be seen that any major failure of a turbine engine reduces its energy with tremendous destructive power.

Decisions on engine regulations, production and location will be of prime importance to safety," he said.

- **Speeds and loads:** How turbine-powered aircraft were designed in a manner similar to today's design practices so that dynamic response characteristics were unchanged and operating practices in terms of cruise speeds and approach between cruise speeds and approach also were the same, then our design needs would look forward to a safety record increasingly comparable to our present aircraft record.

"However, since the turbine engine will differ from our existing aircraft in these respects, a conservative approach to the design speed and gear problem is needed, and close cooperation between industry, CAA, Civil Aeronautics Board and the airlines services must be maintained."

- **Performance:** An "overall" realistic approach to the complex problem of transportation accountability in turbine-powered aircraft must be explored. "Since a turbine engine has about 15% power for a temperature increase of 100°, while the turbojet has about 2 to 3% and the turbofan about 4 to 5%.

• **Safety analysis:** "Experience is a most valuable asset in producing a safe design. We must analyze most thoroughly the aircraft systems, equipment and controls to anticipate everything that could conceivably go wrong and, if the consequences could seriously endanger the aircraft, devise a suitable means of preventing the occurrence or of safely controlling the consequences."

"I have hopes," Lee told IAS members, "that this act and science of safety analysis can become as highly developed as stress weight and performance analysis."

- **Airport Problems:** As far as airports for turbine-powered aircraft are concerned, said Lee, "there seem to be very few technical new problems (other than, of course, the familiar problem of large trees of a poor growing nature."

The CAA Administrator suggested the following recommendations in formulating airport development programs:

- **Intersecting cleared runway intersection with radio aids.**
- **Establish effective wing loss.**
- **Accurate information of only to air navigation.**
- **Most standard requirements for runway length.**
- **Achieving ground noise reduction programs.**
- **Arrange flight patterns to reduce ground noise.**

In order to facilitate and expedite runway operations, Lee recommended the use of parallel runways or other configurations that will permit simultaneous operations and lighted runways to improve with clear ground markings and runway signs.

To eliminate tail-end danger with



English Electric Tests Twin-Jet Supersonic Fighter

Britain's Ministry of Supply has ordered production and pre-production orders of the new English Electric T-4 fighter, which the company says is the first plane designed in

Britain to achieve supersonic speeds in level flight. First T-4 made its initial flight Aug. 4 at the Mho test center at Farnborough, Devon. Powerplants are two Armstrong Siddeley

afterburning of more than 7,200 lb thrust each. T-4s are armed with the of— The T-4 is a three with a low mounted "flying tail."

mered traffic. CAA recommends that well-planned, ground holding areas of atleast 500 ft should be constructed near the end of runways.

"It has been stated, that jets will not be steadily demanding with respect to runway lengths," said Lee. "Being speaking of the 700, states it will be able to operate from existing airports. Also, it is estimated that the traffic flow mechanism development is being accelerated."

He listed three other problems to be faced in construction of runways:

- **Excess of detection** reaching from engine heat blasts and from fuel spillage on taxiways, parking aprons and the ends of the runway. Investigations are underway to develop materials and methods to remove them.

"It may be that blast pads or non-traffic bearing ground cover on the ends of a lightweight paving may be required for a few hundred feet beyond the ends of runways to prevent erosion due to jet blast," he said.

- **It is not anticipated that jet taxiway** port weights will exceed the percent strength recommended for the airport service category," said Lee.
- **Fixed areas, in general, need to be kept free of foreign particles** which can plug, jam or warp jet turbine blades."

► **Traffic Control.** In the U.S. today," Lee said, "there are sufficient military jet operations to saturate the airspace between 20,000 and 40,000 feet over wide areas. Therefore, we are rapidly accelerating our efforts toward finding the best possible solutions in the traffic control and operations problems."

Improvements required to control jet traffic he said, include better weather forecasting, reliable forecasts, and better communication links.

Stassen Defends U.S. Air Aid to Britain

U.S. purchases of British military aircraft were defended strongly by the Administration and condemned on the floor of the Senate following an Appropriations Committee staff report that criticized the effort during passage (Aviation Week Aug. 5, p. 12).

Harold E. Stassen, Foreign Operations Administrator, told a news conference:

"That report is one of the most inaccurate investigations' reports that I have ever seen. We have followed the policy of the U.S. not buying for NATO purposes any plane that is not evaluated at top flight by our own Air Force."

► **Intended Donations.**—Republished Sen. George W. Malone and in the House.

"We have been and are being con-

vinced that Britain's intended dominance over our own aircraft industry and our technology. Britain's aircraft industry, while on one industry, must rely on money from the rest of the world."

At the same time, a Senate Armed Services Committee report said it now is considering launching a thorough investigation of all aspects of defense procurement.

Sen. Malone's criticism came when he offered an amendment to the foreign aid bill that would deny help to nations comprising Red China. The amendment was defeated.

Malone inserted tables in the Congressional Record showing aircraft and equipment purchased by the U.S. in Britain. Total for fiscal 1955: \$7.5 million; for fiscal 1956, it was \$14.7 million. Budget purchase in 1955 was \$148,574,280 for Hawker Hunters.

► **U.S. Self Interest.**—The report states the question: "Should not the United States be supporting its own industry in the United Kingdom? We are not, as far as grants for civil aviation are concerned, and thus, have been a disservice to our trade for this purpose. It is, of course, true that any time you help build a country's military aviation you automatically help build its civil aviation industry."

"Our own aircraft industry gets a great deal from the transportation military orders. Is that not done? Are you going to hold back industry jet aircraft development in the U.K. and in France and other free countries because you are afraid of the cost comparison with U.S. jet companies? Of course not, because you also have the Soviet working in the field."

Therefore, an reply, as we can, and as an aid to the United States, we want more possible aviation technology loans in the free world devoted to rapid, effective future development of jet modern air strength.

"We vigorously defend, in the support of the U.S., the best concrete policy that is questioned in that report," Malone said. "Whether those funds go into commercial aircraft or not, there will be a transfer of technology, and industry and Britain can put those profits into its use to raise the skies, as Britain once raised the seas."

Mickel to New Post

Martha Mickel, one of the editors of Aviation Week and its predecessor since 1943, has joined the editorial staff of the petroleum group of publications in Midland-Hill Publishing Co. Her last Transport Editor in 1947 when, *Air and News* and *Aviation* were consolidated to form *Aviation Week*. He served as Managing Editor and Administrative Assistant to the Editor at Aviation Week.

Lockheed Plans Lab For Atomic Weapons

Lockheed Aircraft Corp. has appropriated \$10 million to establish a new laboratory that will give heavy emphasis on atomic and hydrogen weapons research and coordinate activities with the company's Manned Systems Division.

Final plans for the new lab are taking shape, and work will go ahead on facilities, the company says.

"The end result will be reliable, predictable results, accurate, according to Edward J. Quasius, vice president-general manager of the division, who commanded USAF's Eastern Air Command and the Atomic Energy Commission's first thermonuclear (hydrogen) tests at Eniwetok.

"Today's nuclear weapons," Quasius says, "have far outstripped the means of delivering them on a target." The revolution in weapons effectiveness requires a comparable revolution in measures to deliver them, he adds.

Scientists who have joined the new Lockheed research laboratory include these men:

Dr. E. H. Kraus, head of the facility who resigned as associate director of research at the Naval Research Laboratories, Washington, D. C., to join Lockheed; Kraus directed the nuclear weapons research program conducted jointly by Los Alamos Scientific Laboratories, N. M., and NRL, and was in charge of scientific experiments, including communications, at Eniwetok, during Operation Sandstone, Greenhouse and Ivy.

Dr. Montgomery H. Johnson, associate director, has served since 1952 on the nuclear program staff of the University of California, working on nuclear weapons research. He is considered an authority on atomic and nuclear physics, quantum physics, electrodynamic, subatomic materials, atmosphere and ionosphere research.

Dr. Eric Drexler, who comes to Lockheed from Chicago Midway Laboratories is a specialist in nuclear reactors, radiation, radio and navigation systems, jet engine instruments, rockets, launch and guidance devices.

The staff includes Edward J. Zedler, who resigned as technical advisor and operations analyst at the USAF Special Weapons Center, Randolph AFB, N. M., and then Sen. Kennedy's former director of development, Air Navigation Development Board of Civil Aeronautics Administration.

Lockheed's Manned Systems Division, headed by William M. Hawkins, was established in 1955 and now has 700 employees. Employment is expected to reach 1,000 by the end of the present year.

RADIOGRAPHY makes positive



about negative pressure

Specifications for this tank—designed to operate from vacuum to 25 pounds' pressure—called for welded 35 aluminum. Thus, as welders know, could cause problems. But the builders called on radiography. Here is what they say:

"X-rays played a very important part in the extensive research to determine the most suitable method of welding the vessel. Without the use of x-ray we might never have obtained the high quality and uniform results."

Which shows two important facts. First, that radiography proves the soundness of welds. Second, that it expands the use of the welding process.

This is good reason that today more and more welders make use of radiography. If you would like to know how it can help your business, get in touch with your x-ray dealer and talk it over.

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

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Up where eagles soar

ON WELDED RINGS OF STEEL

Today's jets soaring higher, faster, and farther are a tribute to the imagination and resourcefulness of the aviation industry. American Welding is proud to have contributed to this effort as a supplier of rings, bands and welded assemblies for every major U.S. aircraft engine manufacturer. In many instances, American Welding furnishes these completely finished—welding, machining and assembly all having been done in our plant. Our various divisions working closely with customers have developed new techniques and methods to keep pace with progress in the industry.

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looming, technology will enter—
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to assist you. Write or call, we will
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of Award Winning Facilities
today.



EDWARDS: F-4 makes first vertical takeoff Aug. 1, following a brief period of inclined flight tests (Aviation Week June 21, p. 26). On a subsequent flight, the Navy fighter reached 219-0. Above: T-19 makes powerplant tests dual Carrier Testbeds (page 28)



Navy VTO Fighters Make First Free Flights



LOCKHEED X-2 vertical takeoff fighter leaves the ground horizontally on its speed land landing gear for tests at altitude of its vertical flight capability. Straight-up takeoff and landings with availability of new engines. X-2 also has Allison J40 and General Motors

LA Airport Fights Nike as Hazard

Officials say missile installation endangers aircraft operation and could halt future growth of terminal.

Los Angeles—Army's decision to locate a Nike guided missile battery at Los Angeles International Airport has touched off an angry battle here with city officials who believe the missile battery will be a hazard to airport operations.

The Army wants to place the Nike missile in the airport approach zone.

Airport officials say missile launchers and Nike would be a physical danger to the area, would ruin the field's existing plan and could affect future growth.

In Washington, D. C., Civil Aeronautics Administrator Fred B. Lee was of the dispute. "While the defense needs are certainly important, we also have to keep in mind the need for planning the future of our aviation."

Civil Aeronautics Administration is studying possible interference by the Nike installation on airport electronic landing system.

• **Duff Blodet**—Major James Blodet earned the fight in Washington after calling local Army representatives "balk heads" for making what he terms a

hoax, short-sighted demand. Blodet protested to California Sen. William F. Knowland and Thomas F. Kuchel and to the Secretaries of the Army, Navy, Air Force and Commerce.

He wants the Army to relocate the missile far from the site.

Army spokesmen say the airport location is vital to the Nike network now being set up to protect the Los Angeles production area and that the city's protest is causing a dangerous delay.

The Army says a diversion from the airport site might make it necessary to shift other Nike batteries in the network.

• **284th Missile**—The Army wants to emplace some 25 units in the greater International Airport "cluster" area for the Nike site. Two-thirds of this would be for a launching site at the southwest end of the airport area. The other one-third, sought for radar facilities and berms, is on the center line of the

airport approach area and a mile to the southwest. Closest and would be 7,300 ft. west of the present runway.

The Army insists the battery is not a hazard to airport operations. The highest radar mast will be 20 ft. below the maximum glide path for commercial aircraft even when the runway is extended another 2,500 ft. An Army spokesman says he considers five as adequate safety margins.

• **Present Point**—The site, supported by surface operations and surveillance in the airport area, is being its present on these points:

• Location of the facility on the approach center line is a hazard to air craft taking off and landing at the airport.

• Nike radar equipment now interferes with the airport's electronic navigation facilities.

• Heavy bomber rockets that fall away from the missiles after launching are a hazard to the area.

• The installation may affect the development of the airport master plan.

"We've been making far years to achieve an airport that will give Los Angeles the type of international terminal it should have as the nation's fourth busiest on travel center," an airport spokesman says.

Installation of Nike launchers and radar not only would be a physical danger to the airport area, it would ruin our planning and might well affect future growth of the terminal."

• **Defense Key**—Los Angeles is one of the first cities to be selected for mobilization of the ground-to-air missile, and Army spokesmen say the airport location is one of the key points in the local Nike network.

Opponents of the Army plan point out that other land is available in the area a few thousand feet to the north and south.

• **Big Gun**—Francis M. Day, commander of the 47th Antiaircraft Artillery Brigade at Ft. MacArthur, says location of the facility on land or purchased airport property, as currently planned, would cost about \$740,000. He says this could climb as high as \$2 million if condemnation of other property is required to shift the site.

• **More Deadly Things**—During the argument, the Army listed the facilities planned for the Nike battery, which will include two radars—a launching area and radar tracking center. The unit will contain six launchers supplied from two self-powered magazines.

Gen. Day says there will be no Nike firing from each battery unless Los Angeles actually is under attack. The booster rockets for the missile should fall at sea, he added.

"But if we are attacked," the general says, "there'll be more deadly things than booster cases falling through the sky unless the interceptors are stopped."

Final decision in the dispute is said to be in the hands of Army Secretary Robert Storch—WJC.



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